NOTICE

All drawings located at the end of the document.

000109962

ER/WM&I DDT

Source/Driver: (Name & Number from ISP, IAG milestone, Mgmt. Action, Corres. Control, etc.)

Closure #: (Outgoing Correspondence Control #, if applicable)

Due Date

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Originator Name

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QA Approval

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Document Subject:

TRANSMITTAL OF THE "DRAFT CLOSEOUT REPORT FOR THE SOURCE REMOVAL AT THE TRENCH-1 SITE, IHSS 108, RF/RMRS-99-302.UN, REVISION B" - JEL-053-99

KH-00003NS1A

May 10, 1999

Discussion and/or Comments:

Enclosed please find three (3) copies of the ***"Draft Closeout Report for the Source Removal at the Trench-1 Site, IHSS 108, RF/RMRS-99-302.UN, Revision B"*** **for your review and comment. Additional copies are being distributed directly to the list below for further review and comment. A Comment review sheet is included for your use. Please provide comments to Hopi Salomon by Tuesday, May 18, 1999.**

If you have any questions concerning this document, please contact Hopi Salomon at extension 6627.

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Draft
Closeout Report for the Source Removal at the Trench-1 Site IHSS 108

RF/RMRS-99-302.UN

• Environmental Restoration •
Rocky Flats Environmental Technology Site

May 1999
Revision B

ADMINISTRATIVE INFORMATION

Site: Rocky Flats Environmental Technology Site (RFETS), Golden, Colorado

Project Name: Source Removal at Trench 1 - IHSS 108

Date Prepared: May 7, 1999

Approvals

I have read and approved this Closeout Report with respect to the regulatory requirements and objectives of the project.

John Law
RMRS Environmental Restoration director

Date

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RMRS T-1 Project Manger

Date

Greg DiGregorio
RMRS Quality Assurance

Date

Hopi Salomon
T-1 Sampling Coordinator, Document Author

Date

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APPENDICES

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ACRONYMS

CCR	Colorado Code of Regulations
CDPHE	Colorado Department of Public Health and Environment
CWTF	Consolidated Water Treatment Facility
DU	Depleted Uranium
EPA	Environmental Protection Agency
EPI	Environmental Physics Inc.
FIP	Field Implementation Plan
FIDLER	Field Instrument for the Detection of Low Energy Radiation
HEPA	High Efficiency Particulate Air
IDM	Investigation Derived Materials
IHSS	Individual Hazardous Substance Site
LDR(s)	Land Disposal Restrictions
LLW	Low-Level Waste
MLLW	Mixed Low-Level Waste
NRWOL	Non Routine Waste Origination Log
PAM	Proposed Action Memorandum
PARCC	Precision, Accuracy, Representativeness, Completeness, and Comparability
PCE	Tetrachloroethene
PPE	Personal Protective Equipment
PWRE	Property/Waste Release Evaluation
RAAMP	Radioactive Ambient Air Monitoring Program
RCT(s)	Radiological Control Technicians
RCRA	Resource Conservation and Recovery Act
RFCA	Rocky Flats Cleanup Agreement
RFETS	Rocky Flats Environmental Technology Site
RMRS	Rocky Mountain Remediation Services, LLC
RPD	Relative Percent Difference
SAP	Sampling and Analysis Plan
SIP	Sampling and Inerting Pad
T-1	Trench-1
TCE	Trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TNU	Thermo NuTech
UHC(s)	Underlying Hazardous Constituent(s)
VOA	Volatile Organic Analysis
VOCs	Volatile Organic Compounds
WAC	Waste Acceptance Criteria
WEMS	Waste Environmental Management System
yd^3	Cubic Yard

1.0 INTRODUCTION

This closeout report was prepared to document the results of the excavation phase of a source removal conducted at the Trench-1 (T-1) site which is located at the Rocky Flats Environmental Technology Site (RFETS). T-1 is also known as Individual Hazardous Substance Site (IHSS) 108. The excavation phase of the source removal was completed in August, 1998. This report also includes a summary of the site reclamation activities which included return of Investigation Derived Materials (IDM) from previous site characterization activities at RFETS.

1.1 Background

The T-1 site was located northwest of the inner east gate, about 40 feet south of the southeast corner of the Protected Area fence (Figure 1-1). The trench was approximately 200 feet long, 15 to 20 feet wide, and 10 feet deep. Historical documentation indicated depleted uranium (DU) metal chips (lathe and machine turnings) originating from Building 444 were packed with lathe coolant and buried in the west end and possibly the east end of T-1 in approximately 125 drums. Ten drums of cemented cyanide and one drum of "still bottoms" (recovered waste solvents or evaporated lathe coolant sludge) were also suspected to have been buried in T-1 along with an unknown amount of debris.

Drums disposed of in the trench were reportedly double stacked end-on-end and covered with one to two feet of soil. No written documentation existed for the contents of the center and east end of the trench. However, interviews with former site workers indicated that the eastern two-thirds of the trench was likely to contain trash consisting of pallets, paper, and other debris such as empty or crushed drums. Summaries of the interviews are contained in the project files. Burial operations in the trench continued intermittently from November 1954 to December 1962.

Weed cutting activities conducted in October and November 1982 unearthed the upper portion of two drums not adequately covered with fill material. Samples of the liquids and sludges contained in these drums were collected for radiochemical analyses and yielded low levels of plutonium, and uranium activities that could have been indicative of enrichment.

Since discovery of the drums, site investigations were conducted to evaluate the suspected area of impact and the potential contaminants. These investigations included additional soil and groundwater samples at locations surrounding the trench area, a soil gas survey, an electromagnetic and ground penetrating radar survey, a review of historical aerial photographs, employee interviews, and a detailed records search. Based on a review of the data, impacts of the T-1 contaminants were considered to be primarily confined to the soil within the trench boundaries. Additional, pre-excavation support information on the site background, previous investigative data, suspected radiological and chemical impacts, geology and hydrogeology are documented in the reports listed below:

- Historical Release Report for the Rocky Flats Plant (DOE, 1992);
- Phase II RFI/RI Report for Operable Unit No. 2 - 903 Pad, Mound, and East Trenches Area, Rocky Flats Environmental Technology Site (DOE, 1995a);
- Draft Trenches and Mound Site Characterization Report, (RMRS, 1996b);
- Proposed Action Memorandum for the Source Removal at Trench 1, IHSS 108 (RMRS, 1998a).

1.2 Project Summary

This source removal was conducted in accordance with the Proposed Action Memorandum (PAM) for the Source Removal at Trench 1, IHSS 108 (RMRS, 1998a). This source removal was conducted by Rocky Mountain Remediation Services, L.L.C. (RMRS) on behalf of Kaiser-Hill Company, L.L.C., for the U.S. Department of Energy (DOE)/Rocky Flats Field Office.

Prior to excavating the trench a large freestanding temporary structure was erected by Sprung Structures, Inc. This structure allowed all excavation, initial processing of DU (inerting) and stockpiling of soil and containerized waste to take place within an enclosed weather structure. Following construction of the weather structure, the project team went through a series of drills and a detailed readiness assessment. Excavation activities began on June 10, 1998 after successful completion of the readiness assessment. Supporting documents used by RMRS to complete the project are included in the project files. Following excavation, the Environmental Protection Agency (EPA) granted DOE approval to return Investigation Derived Materials (IDM), in this case soil, to the excavation for use as backfill. This activity is summarized in Section 5.1.

2.0 REMEDIAL ACTION DESCRIPTION

The objectives of this source removal were to:

1) remove all drummed wastes and debris from the trench,

2) remove all contaminated soil exceeding Rocky Flats Cleanup Agreement (RFCA) (DOE, 1996) Tier I action levels for radionuclides, volatile organic compounds (VOCs), and cyanide,

3) and disposition any contaminated soils, drummed waste and debris.

Objectives 1 and 2 were met during Fiscal Year 1998. Unanticipated contaminants encountered during the excavation phase have delayed achievement of objective 3. Unanticipated, widespread chemical contamination was discovered in much of the drummed waste excavated from the trench. As a result, treatment alternatives proposed in the PAM (RMRS, 1998a) are not possible, and alternatives are being investigated. The alternative evaluation is included in the *Trench 1 Waste Characterization and Disposition Pathways Analysis Report*, (RMRS, 1999a).

3.0 EXCAVATION OF THE T-1 SITE

The excavation of T-1 was conducted between June 10, and August 20, 1998. Table 3-1 lists the coordinates of the perimeter of T-1 following excavation. Table 3-2 lists the general progression of excavation activities with respect to date, location (west to east) within the trench and the quantities and types of materials being removed. A hydraulic excavator equipped with a 1.5 yd^3 bucket was used for excavation activities.

TABLE 3-1 COORDINATES OF T-1 EXCAVATION PERIMETER

Easting (ft)	Northing (ft)
2086179.50	749483.50
2086152.75	749480.00
2086114.75	749474.50
2086083.75	749469.00
2086053.75	749464.50
2086027.75	749462.69
2085993.88	749458.63
2085964.00	749456.13
2085953.50	749457.31
2085956.38	749437.88
2085995.50	749442.31
2086029.75	749445.13
2086055.25	749449.69
2086086.00	749453.63
2086117.00	749458.63
2086154.75	749465.69
2086182.00	749469.81
2086179.50	749483.50

State Plane Coordinates, Colorado Central - 0502, surveyed December 21, 1998.

Material removed from the trench was segregated adjacent to the trench into three broad categories:

- Soil,
- Drummed waste including commingled soil from non-intact drums,
- Debris.

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TABLE 3-2 EXCAVATION ADVANCE AND QUANTITIES OF MATERIALS REMOVED

Date	No. Drums		No. Excavator Buckets of Soil				Excavated Soil (yd³)		Packaged	No. Full Waste Packages						Distance
	Intact	Non-Intact	<5000	5000-10,000	>10,000 cpm (NaI (Tl))	>25 ppm	<5,000cpm	>10,000cpm	Debris	55	83	85	110	B-12	B-88	ft (from W)
6/10/98	0	0	9	0	0	0			None	0	0	0	0	0	0	to (-)10
6/12/98	0	0	55	0	0	0			1 drum lid	0	0	0	0	2	0	to (-)20
Week Totals	0	0	[illegible]	0	0	[illegible]				0	0	0	0	[illegible]	0	
Totals To Date	0	0	64	0	0	0	51.2	0		0	0	0	0	2	0	
6/15/98		0	2	0	4	0			None	0	1	0	0	0		
6/16/98	0	0	16	6	10	0			1 drum lid	0	0	0	0	0	3	
6/17/98	3	0	0	0	0	0			None	0	3	0	0	0	0	
6/18/98	2	1	3	0	0	5			Drum	0	2	0	0	1	1	
6/19/98	0	2	6	0	0	3			None	0	0	0	0	1	0	
Week Totals	6	[illegible]	[illegible]	6	14	[illegible]				0	6	0	0	2	4	
Totals To Date	6	3	91	6	14	8	72.8	4.8		0	6	0	0	4	4	
6/22/98	2	3	0	0	9	0			1 drum lid	0	2	0	0	1	2	
6/23/98	2	2	0	4	9	1			2 lids, 2 drum	0	2	0	0	1	2	
6/24/98	4	2	0	0	3	1			2 lids, 3 drum	0	4	0	0	1	1	
6/25/9	7	1	0	0	15	2			4 lids, 2 drum	0	7	0	0	1	3	
6/26/98	0	0	0	0	0	0			None	0	0	0	0	0	0	
Week Totals	15	8	[illegible]	4	36	[illegible]				0	15	0	0	4	8	
Totals To Date	21	11	91	10	50	12	72.8	8		0	21	0	0	8	12	
6/29/98	1	0	6	3	16	18			None	0	1	0	0	0	9	
6/30/98	8	1	0	0	12	8			2 drum lids,	1	8	0	1	1	2	
7/1/98	10	0	0	0	4	0			cartons w/	0	10	0	0	0	1	
7/2/98	0	0	0	0	0	0			None	0	0	0	0	0	0	
7/3/98	0	0	0	0	0	0			None	0	0	0	0	0	0	
Week Totals	19	1	[illegible]	[illegible]	32	26				1	19	0	1	1	12	
Totals To Date	40	12	97	13	82	38	77.6	10.4		1	40	0	1	9	24	
7/6/98	7	1	3	0	5	0			Piping, drum	0	7	0	0	1	1	to 22' mark
7/7/98	5	1	12	3	8	0			2 drum	1	4	0	0	1	2	to 34' mark
7/8/98	11	0	2	1	0	0			2' metal	11	0	0	0	0	0	to 37' mark
7/9/98	15	0	2	0	0	0			8 drum lids	15	0	0	0	0	0	to 39' mark
7/10/98	0	0	0	0	0	0			None	0	0	0	0	0	0	to 39' mark
Week Totals	38	2	[illegible]	[illegible]	[illegible]	[illegible]				27	11	0	0	2	3	
Totals To Date	78	14	116	17	95	38	92.8	13.6		28	51	0	1	11	27	to 39' mark
7/13/98	5	0	0	0	0	0			5 Drum Lids	5	0	0	0	0	0	to 40' mark
7/14/98	5	0	10	9	2	0			4 Drum Lids	5	0	0	0	0	0	to 40' mark
7/15/98	0	0	57	6	0	1			10" length	0	0	0	0	0	0	to 29' mark
7/16/98	4	0	55	3	0	0			4 Drum Lids	4	0	0	0	0	0	to 35' mark
7/17/98	0	0	0	0	0	0			None	0	0	0	0	0	0	to 35' mark
Week Totals	14	0	[illegible]	18	[illegible]	[illegible]				14	0	0	0	0	0	
Totals To Date	92	14	238	35	97	39	214.8	31.6		42	51	0	1	11	27	
7/20/98	5	0	18	1	0	0			6 Drum Lids	5	0	0	0	0	0	
7/21/98	12	0	28	1	0	0			10 Drum Lids	12	0	0	0	0	0	to 44' mark
7/22/98	13	0	45	0	0	0			5-gal can, 12	13	0	0	0	0	0	to 50' mark
7/23/98	0	0	26	0	0	0			None	0	0	0	0	0	0	to 56' mark
7/24/98	0	0	0	0	0	0			None	0	0	0	0	0	0	to 56' mark
Week Totals	30	0	117	[illegible]	0	0				30	0	0	0	0	0	
Totals To Date	122	14	355	37	97	39	349.35	33.9		72	51	0	1	11	27	
7/27/98	0	0	47	8	0	0			None	0	0	0	0	0	0	to 70' mark
7/28/98	3	0	63	0	0	0			1, 55-gal	1	0	2	0	0	0	to 85' mark
7/29/98	0	1	66	0	9	0			2/3 drum	0	0	0	0	1	2	to 95' mark
7/30/98	2	1	72	0	0	0			2 drum lids	2	0	0	0	1	0	to 113'
7/31/98	0	0	45	0	0	0			None	0	0	0	0	0	0	to 120'
Week Totals	5	2	293	8	9	0				3	0	2	0	2	2	
Totals To Date	127	16	648	45	106	39	686.3	43.1		75	51	2	1	13	29	
8/3/98	3	0	72	0	0	0			3 drum lids	2	0	1	0	0	0	to 128'
8/4/98	1	2	48	0	0	0			1 drum lid	1	0	1	0	2	0	to 142'
8/5/98	0	3	0	2	1	0			1 drum lid	1	0	0	0	0	0	to 142'
8/6/98	0	0	0	0	0	0			None	0	0	0	0	0	0	to 142'
8/7/98	0	0	0	0	0	0			None	0	0	0	0	0	0	to 142'
Week Totals	4	5	120	2	1	0				4	0	2	0	2	0	
Totals To Date	131	21	768	47	107	39	824.3	45.4		79	51	4	1	15	29	
8/10/98	0	0	0	0	0	0			None	0	0	0	0	0	0	to 142'
8/11/98	0	0	77	0.25	5	0			1 lid, wire,	0	0	0	0	0	2	to 152'
8/12/98	3	0	69	0	0	0			3 drum lids	0	0	3	0	0	0	to 166'
8/13/98	0	0	0	0	0	0			None	0	0	0	0	0	0	to 166'
8/14/98	8	1	15	0	3	0			8 drum lids	0	0	8	0	2	0	to 167'
Week Totals	11	1	161	0.25	8	0				0	0	11	0	2	2	
Totals To Date	142	22	929	47.25	115	39	1009.5	45.7		79	51	15	1	17	31	
8/17/98	0	1	31	5	6	0			None	0	0	0	0	3	1	to 175'
8/18/98	0	3	6	1	0	0			2 drum rings	0	0	0	0	3	0	to 184'
8/19/98	0	2	3	7	20	0			1 drum ring	0	0	0	0	2	5	
8/20/98	0	0	33	15	17	0			None	0	0	0	0	0	4	to 210'
8/21/98	0	0	0	0	0	0			None	0	0	0	0	0	0	to 210'
Week Totals	0	6	73	28	43	0				0	0	0	0	8	10	
Totals To Date	142	28	1002	75.25	158	39	1093.4	77.0		79	51	15	1	25	41	[illegible]

3.1 Excavation and Segregation of Soil

All soil removed from the trench was screened for VOCs and radionuclides to support segregation described in Table 3-3. Sections 4.2 and 6.6 of this report give a more descriptive analysis of the results of the soil segregation activities.

TABLE 3-3 APPROACH TO SEGREGATION OF T-1 SOIL

Material	Initial Screening Methods	Rule	Decision/Segregation Category	Final Volume
Overburden soil (low potential for pyrophoricity)	Visual Observation FIDLER OVA	No significant staining FIDLER < 5,000 CPM OVA < 25 ppm above background	Segregated to Stockpile 1 (for return to T-1)	1093.4 yd^3 (approx)
		No significant staining FIDLER ≥ 5,000 but ≤ 10,000 CPM OVA < 25 ppm above background	Segregated to Stockpile 2 (later transferred to B-88s for future MLLW disposition)	74.6 yd^3
		No significant staining FIDLER > 10,000 CPM OVA < 25 ppm above background	Containerized in B-88s for future MLLW disposition	106.5 yd^3
		Significant staining or OVA ≥ 25 ppm above background	Containerize in B-88. disposition uncertain	35.5 yd^3

3.2 Excavation and Segregation of Drummed Waste

Approximately 170 drums or containers were removed from T-1 during the initial excavation phase. Intact drums containing depleted uranium and cemented cyanide were removed from the trench, initially characterized, and if they had sufficient structural integrity for hoisting, placed in an overpack drum. If the intact drums did not have sufficient structural integrity, they were placed in 1.6 yd^3 B-12 type waste boxes. All ten drums of cemented cyanide waste were able to be overpacked into drums. Approximately 130 of 160 (≈80%) drums of the radioactive metal (e.g., DU) waste was in a condition which allowed for overpacking. At least five of these 130 drums were deteriorated such that they could not contain liquids, however were still capable of being overpacked. Close inspection of the outside of the drums for pinholes was generally not performed as getting the material to a stable (inerted) state was the primary objective. The remainder (deteriorated drums) were placed into B-12s and covered (inerted) with soil.

All DU and cemented cyanide waste packages were then transferred to the Sampling and Inerting Pad (SIP) where the contents were further characterized, sampled, and segregated by SIP personnel, as required. Drums containing DU chips and turnings were stabilized by inerting with mineral oil at the SIP while B-12 boxes containing deteriorated drum carcasses, DU and soil were further "topped off" with soil to ensure stabilization. Following activities at the SIP, waste packages were temporarily staged within the tent awaiting transfer to the Waste Container Staging Area located outside of the temporary structure.

3.3 Excavation and Segregation of Debris

Other than drum carcasses very little debris was encountered during the T-1 excavation. The non-intact drums were loaded into B-12s with DU and commingled soil. Drum fragments were typically removed as practical, verified free of DU chips/turnings and then placed in a separate B-12 or 3.55 yd^3 B-88 waste box. The other types of debris encountered included a few pieces of pipe, "ice cream cartons" used to hold what was thought to be DU floor sweepings from building 444, and some type of sand paper. Section 6.4 lists more descriptive analysis of the debris.

3.4 Occurrences During Excavation

Several unexpected conditions were encountered during excavation that caused temporary pauses in operation. Considerable efforts were then made by the project team to evaluate the unexpected condition(s) and ensure that proper controls were in place prior to restarting activities. In all of the following cases, the T-1 Project team reacted to the occurrence in accordance with approved procedures. This section details the major pauses which were all related to encountering unexpected materials or conditions during the excavation activities:

- Rapid oxidation of DU (pyrophoric activity)
- Uranium hydride potentially containing tritium
- Asbestos within the cemented cyanide matrix

Several other pauses of a less significant nature than those stated above also occurred during the project. Details of these are contained in the project files.

3.4.1 Rapid Oxidation of DU

Activities were suspended on June 10, 1998 (first day of excavation, first drum removed from the trench) after temperature measurements and visual observations indicated a rapid oxidation of a non-intact drum of DU upon removal from the trench. The observations made trench side included a rapid temperature rise and emanation of smoke from the drum. Changes initiated as a result included performing continuous temperature monitoring of DU until completion of inerting activities and returning non-intact drums to the trench when changes in temperature measurements exceeded action levels. The restart request letter (WRS-030-98) describing the events is in Appendix A-1.

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3.4.2 Potential UH_3/Tritium

On August 5, 1998 several old sample bottles were unearthed in the trench with a marking of "*25 gm UH_3" in ..... unknown*" on one of the containers. The chemical abbreviation UH_3 designates uranium hydride. Another container had the marking "*TU metal powder*"; TU was an abbreviation used at Rocky Flats for "tuballoy" a synonym for depleted uranium. These sample bottles (approximately 30 ml and 250 ml volumes) were located in two small steel cans (about 5 gallon capacity) with a marking of "*to Rocky Flats from Lawrence Livermore*" on at least one of the cans. One of the sample bottles broke open as it was being unearthed and a small flame was observed, possibly on some packing material (insulating sleeve) surrounding the sample jar. Shortly after the flame was observed, personnel got the material in a stable configuration and exited the tent.

Characteristics of uranium hydride were quickly investigated and it was learned that the material was potentially more pyrophoric than what was expected for the T-1 DU. During a meeting with RFETS fire protection engineering personnel, a radiological engineer noted that uranium hydride was sometimes used as a "getter", a material used to store large amounts of tritium, and that this method of storage had been used at Lawrence Livermore National Laboratory. It became apparent that if the "UH_3" material contained tritium, that a release may have occurred. The project team immediately began an investigation to determine if tritium had been released.

The investigation first involved sampling the plastic anti-contamination bags used to cover the various field monitoring equipment that were in use in the tent during the event, earlier that day. This effort was done without making an entry into the tent. The materials being sampled, because of the characteristics and proximity to the flame would likely show evidence of tritium contamination if there had been a release of tritium. Nine plastic bags were sampled the evening of August 5, 1998 for a gross (non-quantitative) tritium analysis performed at the on-site Thermo NuTech (TNU) laboratory, and subsequent offsite analysis at Environmental Physics (EPI). Results from TNU were received the next morning (August 6) and did not show the presence of tritium. Another entry was made August 7 to collect samples from water, soil and other material in close proximity to the original event. These were analyzed by TNU onsite on August 7 and also shipped to EPI later that day. All results, including those received from EPI on August 10 concluded that tritium was not present in any of the material sampled. The "UH_3" material itself was never sent for tritium analysis because of safety concerns associated with transportation and handling of this highly reactive material. Note that all tritium analysis performed in support of this investigation was conducted under sample numbers 98A2121-001 to -018.

Based upon subsequent gamma spectroscopy analysis (samples 98A2105-187, 203, 204, 207) of the material contained in the unearthed sample bottles, it was determined that the material sampled was not DU but rather had isotopic U-235 to U-238 mass ratios more indicative of natural uranium (the historic sample bottle labeled TU was not sampled because it was assumed to be known material: DU).

Considering the gamma spectroscopy results, it is assumed that the UH_3 contains a natural isotopic uranium distribution. Air monitoring results described in Section 4.3.3 confirm that isotopic ratios identified from a filter pulled from a trench side air monitoring station (T1-B) after the fire indicated elevated "natural uranium" at essentially the same isotopic mix as the historic "UH_3" samples themselves. This was the only natural uranium isotopic distribution observed from trench side air monitoring stations during the excavation. Assuming that the "UH_3" material contains a natural isotopic uranium distribution, it is probable that the sample that caused the "flame up" was originally "UH_3" material. Analysis of the air filter also indicated no tritium above background levels which further suggests that this "UH_3" was not a source of tritium.

On August 10, 1998, a limited restart letter was issued (WRS-049-98) for continuation of all T-1 activities except sampling of waste containing "UH_3". The final restart letter addressing sampling of the "UH_3" material (WRS -051-98) was issued on September 1, 1998 (See Appendix A-2).

During backfilling operations in December, 1998 a 5-gallon container was discovered in the sidewall of the trench. The excavation of this container and related investigations are discussed later in this report. However, this pail contained historic sample bottles similar to what has been discussed above and is therefore addressed below.

On March 10, 1999, Trench 1 personnel were performing an evolution in a soft-sided containment within the T-1 tent structure to inert two samples of uranium hydride removed from the five-gallon container discovered at Trench 1 on December 18, 1998 (REF: RFO--KHLL-ENVOPS-1998-002). Prior to this event the two samples were analyzed using gamma spectroscopy and the results were indicative of natural uranium considering the tolerances established for isotopic uranium ratios for the project. The two glass sample jars were placed in a 55-gallon steel drum on a layer of soil. The first sample jar which also contained a small amount of liquid was covered with soil, followed by the second sample jar which contained no liquid. The first sample jar was broken; there was no response from a tritium detector placed near the jars. The second sample jar was then broken. Approximately two to three seconds later, the alarm sounded on the tritium detector. The alarm point was set at 25 $\mu Ci/m^3$; the local indicator showed a maximum reading of 49 $\mu Ci/m^3$ and then began falling as the instrument cleared itself. Project personnel poured an additional five-gallon bucket of sand over the inerted samples, began a controlled evacuation of the T-1 tent and the soft-sided containment, and assembled in Building T900F. RCT's supporting the evolution inside the soft-sided containment surveyed the surface of the material in the 55-gallon drum for beta contamination that might have triggered the alarm. All personnel that were inside the soft-sided containment were checked by RCT's to determine if there was any spread of contamination. Results indicated that there was not.

After assembling in Building T900F, personnel involved in the evolution completed a short debriefing. At the debriefing, all personnel inside the T-1 weather structure at the time of the event were directed to report to Occupational Medicine for bioassay sampling, and notifications of the event were made.

The following day, twelve samples were collected for tritium analysis (samples 99A5915-001 to -009, -012, -013). The samples were collected from items that could contain tritium if a tritium release had occurred (e.g., poly and cardboard liner of drum D93476, air mover inlet, etc.). The samples were analyzed at an onsite and offsite laboratory. One sample (99A5915-013.002) indicated tritium above the MDA. This sample was collected as a smear sample from the poly ball on a radiological monitoring instrument and indicated tritium activity at 150 pCi/wipe. The corresponding MDA was 120 pCi/wipe with an error 82 pCi/wipe. Results of tritium bioassay analysis indicated low levels of tritium uptake occurred in some of the workers located adjacent to the inerting operations. The tritium uptakes were assigned to several individuals as the bioassay results were all above the Decision Level for tritium, but most were below the Detection Limit (MDA) for tritium. The doses assigned were all in the micro-rem range.

3.4.3 Discovery of Asbestos in Cemented Cyanide Waste

Excavation activities were also suspended on August 12, 1998 due to an observation of asbestos-like material within the cemented matrix of drums containing cyanide waste. Ten drums of cemented cyanide were expected to be encountered during the excavation based on historical reports, however, no indication was given that the cemented cyanide waste contained asbestos. T-1 personnel noticed what appeared to be asbestos during sampling of the drums on August 12. As a result, personnel from an offsite laboratory were called to Rocky Flats the evening of August 12 and confirmed the presence of asbestos (15-25% by volume) in the samples evaluated. The following morning all personnel requiring asbestos awareness received the appropriate training. Asbestos samples were also collected from the Continuous Air Monitors (CAMs) and other materials located at the tent vestibules. No asbestos was detected, indicating asbestos was not released. This was expected as the cemented media was relatively damp and intrusive sampling activities would have little chance of causing a release in the damp matrix. Analytical results from the cemented cyanide can be found in samples 98A2109-001 through -014. The project restart letter, WRS-053-98 was issued on August 13 (See Appendix A-3).

4.0 VERIFICATION SAMPLING FOR T-1

This section describes the verification sampling conducted in support of the excavation phase of the T-1 project. Included are descriptions of the excavation and stockpile verification sampling and the air monitoring performed around the trench.

4.1 Excavation Verification Sampling

In accordance with the T-1 Sampling and Analysis Plan (SAP, RMRS, 1998c), soil samples from the floor and sidewalls of the trench excavation were collected and analyzed for radionuclide and non-radionuclide contaminants of concern. Figure 4-1 depicts the approximate sampling locations within the trench. A summary of the results of the radiological and chemical analysis are presented in Tables 4-1 and 4-2, respectively. The corresponding sample locations are depicted in Figure 4-1. The analytical results indicate that for all contaminants of concern, concentrations are well below RFCA action levels, including sum-of-ratios values less than one, which is used for evaluating risk posed by the collective summation of radionuclides. These results indicate, with satisfactory statistical confidence, that contaminants previously in the trench have been successfully remediated relative to RFCA action levels.

Sample results were used for decision-making on a sample by sample basis, i.e., for each grid cell associated with each particular sample. This approach, as described in the SAP (RMRS, 1998c), was not statistical but rather deterministic and more conservative in that any one sample exceeding the RFCA criteria was required to be remediated and resampled. However, no individual samples on the floor or on the walls exceeded RFCA thresholds – no additional remediation beyond the original excavation was warranted.

Accuracy and precision of the sample results were adequate based on gamma spectrometry quality controls and evaluation of concentration variability, both within individual sampling cells (of the sampling grid) and throughout the excavation population as a whole. Samples were representative of the excavation boundaries based on compliance with the RMRS SAP.

TABLE 4-1 SUMMARY OF RADIONUCLIDE RESULTS FROM EXCAVATION FLOOR AND SIDEWALLS

Sample Number	Location	QC Type	Collection Date	Am-241 (pCi/g)	Pu-239/240 (pCi/g)	U-234 (pCi/g)	U-235 (pCi/g)	U-238 (pCi/g)	Sum-of-Ratios Tier I
98A2111-001	EB0200	REAL	8/27/98	0.51	2.23	2.41	0.27	2.41	0.01
98A2111-002	EB0401	REAL	8/31/98	0.38	1.69	3.30	0.20	3.30	0.01
98A2111-003	EB0301	REAL	8/27/98	0.46	2.01	5.12	0.25	5.12	0.02
98A2111-004	EB0201	REAL	8/27/98	0.54	2.39	2.52	0.27	2.52	0.01
98A2111-005	EB0101	REAL	8/27/98	0.40	1.74	2.04	0.23	2.04	0.01
98A2111-006	EB0402	REAL	8/31/98	0.42	1.85	6.64	0.22	6.64	0.02
98A2111-007	EB0302	REAL	8/27/98	0.50	2.18	2.53	0.26	2.53	0.01
98A2111-008	EB0202	REAL	8/27/98	0.49	2.16	2.53	0.28	2.53	0.01
98A2111-009	EB0102	REAL	8/27/98	0.42	1.83	2.36	0.23	2.36	0.01
98A2111-010	EB0403	REAL	8/31/98	0.42	1.83	2.24	0.24	2.24	0.01
98A2111-011	EB0303	REAL	8/27/98	0.44	1.93	2.54	0.25	2.54	0.01
98A2111-012	EB0203W	REAL	8/27/98	0.43	1.88	2.19	0.24	2.19	0.01
98A2111-013	EB0203C	REAL	8/27/98	0.41	1.80	1.49	0.24	1.49	0.01
98A2111-014	EB0203E	REAL	8/27/98	0.43	1.88	4.52	0.25	4.52	0.02
98A2111-015	EB0203E	DUP	8/27/98	0.46	2.01	4.41	0.25	4.41	0.02
98A2111-016	EB0103	REAL	8/27/98	0.44	1.94	4.54	0.25	4.54	0.02
98A2111-017	EB0404	REAL	8/31/98	0.52	2.29	5.08	0.28	5.08	0.02
98A2111-018	EB0304	REAL	8/28/98	0.40	1.78	3.75	0.19	3.75	0.01
98A2111-019	EB0204	REAL	8/28/98	0.44	1.92	4.11	0.22	4.11	0.01
98A2111-020	EB0104	REAL	8/28/98	0.44	1.93	3.86	0.14	3.86	0.01
98A2111-021	EB0405	REAL	8/31/98	0.42	1.84	4.51	0.13	4.51	0.01
98A2111-022	EB0305W	REAL	8/28/98	0.43	1.88	4.24	0.16	4.24	0.01
98A2111-023	EB0305C	REAL	8/28/98	0.48	2.10	4.35	0.24	4.35	0.02
98A2111-024	EB0305E	REAL	8/28/98	0.42	1.85	2.56	0.22	2.56	0.01
98A2111-025	EB0205	REAL	8/28/98	0.44	1.92	4.49	0.08	4.49	0.01
98A2111-026	EB0105	REAL	8/28/98	0.48	2.11	2.34	0.25	2.34	0.01
98A2111-027	EB0406	REAL	8/31/98	0.44	1.96	4.30	0.25	4.30	0.02
98A2111-028	EB0406	DUP	8/31/98	0.40	1.78	3.95	0.23	3.95	0.01
98A2111-029	EB0306	REAL	8/28/98	0.48	2.10	2.29	0.24	2.29	0.01
98A2111-030	EB0206	REAL	8/28/98	0.44	1.94	2.05	0.25	2.05	0.01
98A2111-031	EB0106	REAL	8/28/98	0.42	1.84	2.03	0.24	2.03	0.01
98A2111-032	EB0407	REAL	8/31/98	0.43	1.91	2.15	0.24	2.15	0.01
98A2111-033	EB0307	REAL	8/28/98	0.40	1.77	2.03	0.20	2.03	0.01
98A2111-034	EB0207	REAL	8/28/98	0.41	1.82	2.13	0.23	2.13	0.01
98A2111-035	EB0107	REAL	8/28/98	0.54	2.36	2.75	0.29	2.75	0.01
98A2111-036	EB0408	REAL	8/31/98	0.49	2.16	2.34	0.28	2.34	0.01
98A2111-037	EB0308	REAL	8/31/98	0.47	2.05	2.48	0.25	2.48	0.01
98A2111-038	EB0308	DUP	8/31/98	0.43	1.90	2.31	0.25	2.31	0.01
98A2111-039	EB0309C	REAL	8/31/98	0.48	2.10	4.84	0.23	4.84	0.02
98A2111-040	EB0309E	REAL	8/31/98	0.51	2.26	2.43	0.15	2.43	0.01
98A2111-041	EB0208	REAL	8/31/98	0.47	2.08	2.42	0.25	2.42	0.01
98A2111-042	EB0108	REAL	8/31/98	0.51	2.22	5.15	0.30	5.15	0.02
98A2111-043	EB0409	REAL	8/31/98	0.51	2.26	11.88	0.32	11.88	0.03
98A2111-044	EB0309W	REAL	8/31/98	0.46	2.02	4.59	0.26	4.59	0.02
98A2111-045	EB0209	REAL	8/31/98	0.47	2.05	4.64	0.24	4.64	0.02
98A2111-046	EB0109	REAL	8/31/98	0.41	1.82	4.03	0.23	4.03	0.01
98A2111-047	EB0211	REAL	8/31/98	0.44	1.93	2.19	0.26	2.19	0.01
98A2111-051	EB0410	REAL	8/31/98	0.40	1.76	4.00	0.21	4.00	0.01
98A2111-052	EB0310	REAL	8/31/98	0.49	2.17	5.35	0.24	5.35	0.02
98A2111-053	EB0210	REAL	8/31/98	0.50	2.22	4.80	0.21	4.80	0.02
98A2111-054	EB0110	REAL	8/31/98	0.51	2.23	4.45	0.27	4.45	0.02
Tier I Subsurface Soil Action Levels				215	1429	1738	135	586	

Notes: For results less than MDA, MDA is reported. U-238 concentration is derived from Pa-234m when detected and Th-234 when Pa-234m is not detected. U-234 concentration is derived directly from U-238 concentration in accordance with the SAP (RMRS, 1998c). All results are on a dry basis.

Table 4-2
ANALYTICAL CHEMISTRY RESULTS from T-1 EXCAVATION BOTTOM & SIDEWALLS[1]
(all Concentrations in ug/kg)

RIN-EVENT	Location	Acetone		Carbon disulfide		Methylene Chloride		2-Butanone		Bromoform		Toluene		PCE		TCE		PCBs[2,4]	Cyanide
	(RFCA Action Levels)[3]	2.74E+06		4.32E+04		5.77E+03		TBD		1.79E+05		2.04E+06		1.15E+04		9.27E+03		9.50E+04	TBD
98A2111-001	EB0200	34	J	25	U	25	U	14	J	25	U	25	U	25	U	25	U	ND	NA
98A2111-002	EB0401	50	U	25	U	21	J	8.6	JB	25	U	25	U	25	U	25	U	ND	NA
98A2111-003	EB0301	15	J	25	U	25	U	8.4	JB	25	U	25	U	25	U	25	U	ND	NA
98A2111-004	EB0201	14	J	25	U	25	U	50	U	25	U	25	U	25	U	25	U	ND	NA
98A2111-005	EB0101	15	J	25	U	25	U	9.7	JB	25	U	25	U	25	U	25	U	ND	NA
98A2111-006	EB0402	50	U	25	U	13	J	7.7	JB	25	U	25	U	25	U	25	U	ND	NA
98A2111-007	EB0302	50	U	5.3	J	25	U	5.7	JB	7.9	J	25	U	25	U	25	U	ND	NA
98A2111-008	EB0202	16	J	25	U	25	U	50	U	25	U	25	U	25	U	25	U	ND	NA
98A2111-009	EB0102	50	U	25	U	25	U	50	U	5.4	J	25	U	25	U	25	U	ND	NA
98A2111-010	EB0403	50	U	25	U	9.7	J	50	U	25	U	25	U	25	U	25	U	ND	NA
98A2111-011	EB0303	50	U	25	U	25	U	8.2	JB	25	U	25	U	25	U	26	U	NA	NA
98A2111-012	EB0203W	50	U	25	U	25	U	9.1	JB	25	U	25	U	25	U	25	U	NA	NA
98A2111-013	EB0203C	50	U	25	U	25	U	50	U	25	U	25	U	25	U	25	U	NA	NA
98A2111-014	EB0203E	50	U	25	U	25	U	50	U	25	U	25	U	25	U	25	U	NA	NA
98A2111-015	EB0203E	50	U	25	U	25	U	50	U	11	J	25	U	25	U	25	U	NA	NA
98A2111-016	EB0103	50	U	25	U	25	U	9.5	JB	25	U	25	U	25	U	25	U	NA	NA
98A2111-017	EB0404	15	J	25	U	7	J	11	JB	25	U	6.7	J	25	U	25	U	NA	NA
98A2111-018	EB0304	70	B	25	U	25	U	9.5	JB	25	U	25	U	25	U	25	U	NA	NA
98A2111-019	EB0204	32	JB	25	U	25	U	9.3	JB	25	U	25	U	25	U	25	U	NA	NA
98A2111-020	EB0104	50	U	25	U	25	U	50	U	25	U	25	U	25	U	25	U	NA	NA
98A2111-021	EB0405	32	J	25	U	6.8	J	14	JB	25	U	25	U	25	U	25	U	NA	NA
98A2111-022	EB0305W	50	U	25	U	7.2	J	50	U	25	U	25	U	25	U	25	U	ND	NA
98A2111-023	EB0305C	16	JB	25	U	25	U	11	JB	25	U	25	U	25	U	25	U	ND	NA
98A2111-024	EB0305E	15	JB	25	U	25	U	12	JB	25	U	25	U	25	U	25	U	ND	NA
98A2111-025	EB0205	33	J	19	JB	25	U	10	JB	25	U	25	U	25	U	25	U	ND	NA
98A2111-026	EB0105	34	JB	25	U	25	U	17	JB	25	U	25	U	25	U	25	U	ND	NA
98A2111-027	EB0406	50	U	9.3	JB	25	U	9.4	JB	25	U	25	U	25	U	25	U	ND	NA
98A2111-028	EB0406	18	JB	6.1	JB	25	U	12	JB	25	U	25	U	25	U	25	U	ND	NA
98A2111-029	EB0306	16	JB	25	U	25	U	12	JB	25	U	25	U	25	U	25	U	ND	NA
98A2111-030	EB0206	50	U	25	U	25	U	11	JB	25	U	25	U	25	U	25	U	ND	NA
98A2111-031	EB0106	26	J	25	U	25	U	13	JB	25	U	25	U	25	U	25	U	ND	NA
98A2111-032	EB0407	15	JB	9.5	JB	25	U	50	U	25	U	25	U	25	U	25	U	ND	NA
98A2111-033	EB0307	40	J	25	U	25	U	13	JB	25	U	25	U	25	U	25	U	ND	NA
98A2111-034	EB0207	25	J	25	U	25	U	13	JB	25	U	25	U	25	U	25	U	ND	NA
98A2111-035	EB0107	20	J	25	U	25	U	12	JB	25	U	5.6	J	25	U	25	U	ND	NA
98A2111-036	EB0408	17	JB	25	U	25	U	10	JB	25	U	6.1	J	25	U	25	U	ND	NA
98A2111-037	EB0308	60		25	U	25	U	23	JB	25	U	25	U	25	U	25	U	ND	NA
98A2111-038	EB0308	27	J	25	U	25	U	13	JB	5.4	J	25	U	25	U	25	U	ND	NA
98A2111-041	EB0208	50	U	25	U	25	U	11	JB	25	U	25	U	25	U	25	U	ND	NA
98A2111-042	EB0108	50	U	25	U	25	U	12	JB	25	U	25	U	25	U	25	U	ND	NA
98A2111-043	EB0409	2	J	25	U	29		11	JB	25	U	25	U	25	U	25	U	ND	NA
98A2111-044	EB0309W	54		25	U	25	U	14	JB	25	U	25	U	25	U	25	U	ND	3,700
98A2111-039	EB0309C	50	U	25	U	26	U	12	JB	25	U	25	U	25	U	25	U	ND	7,000
98A2111-040	EB0309E	25	JB	25	U	25	U	10	JB	25	U	25	U	25	U	25	U	ND	29,000
98A2111-045	EB0209	35		25	U	25	U	22	JB	25	U	25	U	25	U	25	U	ND	17,000
98A2111-046	EB0109	50	U	25	U	25	U	13	JB	25	U	25	U	25	U	25	U	ND	1,400
98A2111-051	EB0410	50	U	25	U	23	J	11	JB	25	U	25	U	25	U	25	U	ND	1000 U
98A2111-052	EB0310	20	JB	25	U	25	U	12	JB	25	U	25	U	25	U	25	U	ND	NA
98A2111-053	EB0210	16	JB	25	U	25	U	12	JB	25	U	25	U	25	U	25	U	ND	NA
98A2111-054	EB0110	27	JB	25	U	25	U	13	JB	25	U	25	U	25	U	25	U	ND	NA
98A2111-047	EB0211	43	JB	25	U	25	U	18	JB	25	U	25	U	25	U	25	U	ND	NA
SAMPLE TALLY		48 real; 3 QC		48 real; 3 QC		48 real; 3 QC		48 real; 3 QC		48 real; 3 QC		48 real; 3 QC		48 real; 3 QC		48 real; 3 QC		38 real; 2 QC	6 real

KEY for Laboratory Qualifiers
U= Below Detection limit
J= Below Instrument Detection Limit
B= Found in Trip Blank

[1]Table represents compounds detected at least once (from drum samples) in the project; no other compounds were detected by the analytical methods used.
[2]PCBs include Aroclor-1016,1221,1232,1242,1248,1254,1260; typical detection limits ranged from 90 to 170 ug/kg
[3]From RFCA Attachment 5, Table 4 - Tier I Subsurface Soil Action Levels (note that these levels are more conservative than Tier II Surface Soil Action Levels)
[4]RFCA Action Level given is for Aroclor-1016, which is the most conservative

4.2 Stockpile Verification Sampling

Both the less than 5,000 counts per minute (cpm) and 5,000-10,000 cpm stockpiles were sampled following excavation. The following two subsections address each stockpile.

4.2.1 Less than 5,000 cpm Stockpile

The clean soil stockpile (Stockpile 1) consisted of almost 1,100 yd^3 of excavated soil that was originally segregated based on FIDLER instrument readings of less than 5,000 cpm. Three samples from the clean soil stockpile were collected and analyzed to characterize the soil stockpile as prescribed in the T-1 SAP (RMRS, 1998c). The samples were analyzed for volatile organic compounds and for radionuclides using gamma spectroscopy. No VOCs were detected in any of the samples. The gamma spectroscopy data were evaluated based on the Environmental Protection Agency's (EPA) G-4 algorithm for determining the minimum amount of samples required for a given statistical confidence level (EPA, 1994. *Guidance for the Data Quality Objectives Process*, EPA QA/G-4, Document No. EPA/600/R-96/055). The algorithm was modified in two ways:

- the t-statistic was substituted for the Z-score based on the small number of samples representing the stockpile population; this approach is more conservative and results in a higher estimate of samples needed, and

- a lognormal transformation of the data was performed based on the lognormal distribution of radionuclides in the RFETS environment (historical data for several RFETS Operable Units have established this statistical characteristic). Assumptions of normality, when the data are more accurately lognormal, would result in estimates that are biased low for adequate sample quantities, but are provided in the spreadsheet for comparative purposes.

Reduction and analysis of the sample data is presented in Table 4-3. Based on a data quality objective (DQO) of at least 90% confidence in the number of samples needed to adequately characterize the stockpile (relative to RFCA Tier II Subsurface Soil Action Levels for radionuclides), and based on the lognormality of radionuclide data, a minimum of 15 total samples was calculated to be required.

Based on the three-dimensional geometry of the soil stockpile (cone-shaped, with a height of approximately 16 feet), and the associated radiological and general Health & Safety issues associated with its geometry and location in the T-1 structure, sampling was limited to a systematic design. The grid was designed to collect representative samples symmetrically around the basal perimeter of the stockpile (in contrast to a simple random sample design). Although not truly random, such a design should be representative of the trench excavation based on mixing of the soils during formation of the pile from the northern to the southern portions of the pile. Samples were acquired at approximately 5 feet above grade, at a regular lateral spacing around the periphery of the stockpile, and from approximately 2 to 18 inches in depth; schematics of the design and additional detail is documented in the T-1 Project Sampling Logbook (RMRS Control No. ER-IHSS108-LB-98-338).

Results of the data set from stockpile sampling are presented in Table 4-3. Relative to Tier II action levels, and using the lognormal 95% UCL for all RFCA radionuclide concentrations in the sum-of-ratios, the sum results in a value well less than one, which indicated that the soil stockpile, in total, was satisfactory for return to the excavation.

TABLE 4-3 SUMMARY OF RADIONUCLIDE ANALYTICAL RESULTS FOR THE CLEAN SOIL STOCKPILE

Sample Number	QC Type	Collection Date	Am-241 (pCi/g)	Pu-239/240 (pCi/g)	U-234 (pCi/g)	U-235 (pCi/g)	U-238 (pCi/g)		
98A2112-001	REAL	8/25/98	0.44	1.93	22.77	0.63	22.77		
98A2112-002	REAL	8/25/98	0.60	2.66	3.23	0.18	3.23		
98A2112-003	REAL	8/25/98	0.76	3.34	50.67	0.90	50.67		
98A2112-004	DUP	8/25/98	0.92	4.06	82.28	1.23	82.28		
98A2112-006	REAL	9/2/98	0.61	2.67	8.61	0.23	8.61		
98A2112-007	REAL	9/2/98	0.71	3.13	13.97	0.46	13.97		
98A2112-008	REAL	9/2/98	1.18	5.21	26.60	0.78	26.60		
98A2112-009	REAL	9/2/98	0.50	2.18	3.44	0.18	3.44		
98A2112-010	REAL	9/2/98	0.76	3.34	26.05	0.61	26.05		
98A2112-011	REAL	9/2/98	0.65	2.88	13.59	0.27	13.59		
98A2112-012	REAL	9/2/98	0.77	3.38	40.20	0.60	40.20		
98A2112-013	REAL	9/2/98	0.82	3.61	5.27	0.24	5.27		
98A2112-014	REAL	9/2/98	2.39	10.53	17.05	0.22	17.05		
98A2112-015	REAL	9/2/98	0.60	2.66	23.88	0.44	23.88		
98A2112-016	REAL	9/2/98	0.24	1.03	4.98	0.25	4.98		
98A2112-017	REAL	9/2/98	0.63	2.78	13.82	0.44	13.82		
Mean Value			0.79	3.47	20.38	0.45	20.38		
Standard Deviation			0.49	2.17	20.07	0.29	20.07		
Variance			0.24	4.72	402.79	0.08	402.79		
Tier I Subsurface Soil Action Levels			215	1429	1738	135	586		
Tier II Subsurface Soil Action Levels			38	252	307	24	103		
								Sum-of-Ratios	
H statistic			2.068	2.068	2.6	2.17	2.6	Tier I	Tier II
Normal 95% UCL			1.01	4.46	29.51	0.58	29.51	0.08	0.45
LogNormal 95% UCL			1.04	4.56	40.57	0.64	40.57	**0.11**	**0.60**

Notes: (based on stkp-gamma-final.xls)

For results less than MDA, MDA is reported

U-238 concentration is derived from Pa-234m when detected and Th-234 when Pa-234m is not detected

U-234 concentration is derived directly from U-238 concentration in accordance with the SAP (RMRS, 1998c)

All results are on a dry basis

The duplicate sample 98A2112-004 is used in calculations in lieu of 98A2112-003 (corresponding real) because it is conservative (higher concentration)

4.2.2 5,000 cpm to 10,000 cpm Stockpile

Soil placed in Stockpile 2 contained soil that was segregated based on radionuclide screening between 5,000 and 10,000 CPM with a FIDLER. It was thought possible that soil with FIDLER values below 10,000 CPM could have radionuclide soil concentrations below the RFCA Tier I Subsurface Soil Action Levels (using a sum-of-ratio evaluation), and could potentially be returned to T-1 as backfill. However, analytical data did not support this assumption. Five samples (RIN 98A2113) were collected in accordance with the T-1 SAP (RMRS, 1998c) to make the evaluation. Results indicated that the soil was at the Tier I action level and approximately 5 times the Tier II action level for radionuclides. As a result, this soil was not considered an acceptable candidate for return to the excavation and was subsequently placed in twenty one B-88 waste boxes. This material is further addressed in Section 6.6 of this report.

4.3 Trench 1 Ambient Air Monitoring

An enhanced, project-specific ambient air monitoring program was implemented during excavation, segregation, sampling, and inerting of depleted uranium chips and associated soils and wastes and was continued through backfilling operations at T-1. The ambient air monitoring was performed to ensure that the potential radionuclide emissions from the T-1 source removal project did not exceed the Site 10 millirem (mrem) per year public dose standard specified in Title 40 of the Code of Federal Regulations (CFR), Part 61, Subpart H, Section 61.92.

The project-specific ambient air monitoring for T-1 consisted of enhanced routine monitoring in the immediate vicinity of the T-1 project using the existing Radioactive Ambient Air Monitoring Program (RAAMP) network at the Site. To characterize the radionuclide emissions generated by activities conducted inside the temporary structure, three high-volume particulate air samplers were located near the activities with the greatest potential to release radionuclides into the atmosphere. Results of the ambient air measurements outside the T-1 tent structure are several orders of magnitude lower than inside the tent. This behavior suggests that the tent was very effective in attenuating air emissions from the project. Appendix B summarizes the result of the T-1 Air Monitoring Program, including supporting figures and graphs.

5.0 SITE RECLAMATION

The following sections address general site reclamation activities including the disposition of drummed Investigation Derived Material (IDM) i.e., soil and return of clean, previously excavated soil back to the trench. This section also discusses the initial details associated with a five gallon container encountered during the backfilling operations.

5.1 Disposition of RFETS IDM at T-1

DOE obtained EPA approvals for placement of drummed IDM (soil) into the T-1 excavation as backfill (see Appendix C). The IDM was generated during past remedial investigation drilling activities at RFETS. EPA approved IDM drums for return to T-1 based on an assessment of existing radionuclide and VOC data. The criteria used for drum acceptability for backfill disposition were that existing data be below RFCA Tier II action levels for radionuclides and Tier I action levels for VOCs. The IDM work at the Trench 1 site involved emptying and stockpiling the acceptable drums/contents inside the tent structure and then transferring the stockpiled material into the T-1 excavation.

Transfer of IDM drums from the 904 Yard/Tent 10 to the T-1 site began on October 23, 1998. The drums were secured on pallets on a flatbed trailer for transport. Stockpiling of the IDM soil within the Trench 1 tent structure began on November 3, 1998 and ended on December 15, 1998. The drums were typically emptied using a drum "tipper" mounted on forklift trucks. Periodic radiological surveys were performed on the IDM soil, drum liners and drums. Enhanced surveys were performed on IDM drums originating from the 903 Pad and East Trenches areas as directed by Radiological Engineering (i.e., surveys of the drum interior, drum contents, drum lids, and drum liners). All drums holding free-standing water were decanted at the 904 Decon Pad prior to transfer to the Trench 1 site.

A total of 1,434 IDM drums were emptied and the contents placed in the trench excavation following approval by EPA. The stockpiled IDM soil was transferred to the excavation on December 17, 1998 using a front loader. The IDM material was deposited on the excavation bottom six inches to as much as two feet deep (in low areas of the excavation) from the east extent of the excavation to approximately 175 feet from the east extent. The IDM has since been covered with soil from the T-1 clean soil (<5,000 cpm) stockpile. Appendix C contains a table which lists the IDM drums emptied at the Trench 1 site by the RFETS Waste Environmental Management System (WEMS) container number.

5.2 Encounter of Container During Backfill Operations at T-1

A five-gallon metal container was discovered in the T-1 excavation on December 18, 1998. The metal container was exposed by heavy equipment on the north wall of the trench excavation during backfill operations.

The newly discovered metal container was observed approximately 2.5-3 feet below ground surface on the north sidewall at approximately the 142-foot mark measured from the 0' marker stake at the west extent of the excavation (see Figure 4-1). The container appeared to be intact and undamaged when exposed. The metal container resembled similar five-gallon containers

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previously exhumed during the project and therefore potentially contained pyrophoric materials. Direct radioactivity measurements on the container indicated 55,182 CPM using a FIDLER. No removable radioactivity on the container exterior was observed. The area around the container was posted as a Radioactive Material Area (RMA).

Prior to removal of the metal container from the north excavation wall, an electromagnetic metal detection geophysical survey and a magnetic survey were performed above the known container location, as well as around the entire excavation perimeter. Results of the survey were used to evaluate if other containers were buried in the vicinity of T-1. The geophysical report is included as Appendix E. The effect of metallic objects in the structure and anchor bolt tie-downs of the T-1 tent base complicated data interpretation. The survey identified 13 individual buried metal objects in the vicinity of T-1, including the known, 5 gallon container. Two of the anomalies were similar in size and shape to the known 5 gallon container, and were part of an area identified a Zone C. Eight of the anomalies were considered to be small metal items buried at shallow depths. The remaining two anomalies were considered likely to be buried metal survey stakes.

The 5 gallon container and the two items indicating similar anomalous geophysical readings were subsequently excavated. The 5 gallon metal container contained historic sample bottles similar to what had been previously removed from the trench (see Section 3.4.2). The other items were a metal "No Smoking" sign and the lid of a small container. A Field Implementation Plan (RMRS, 1999b) was developed to address removal and characterization of the materials identified by the geophysical survey as likely to contain buried waste near T-1.

5.3 Return of Stockpiled T-1 Soil to the Excavation

In addition to the Clean Soil Stockpile confirmation sampling described in Section 4.2, EPA and CDPHE re-analyzed samples originally analyzed using gamma spectroscopy at the on-site laboratory. The agencies results confirmed the project gamma spectroscopy results. As a result, EPA granted approval to return the contents of the Clean Soil Stockpile to the excavation for use as backfill. Appendix C contains a letter from EPA to DOE approving the use of this soil as backfill material. Return of this soil for use as backfill was completed on March 4, 1999.

5.4 Removal of the Tent Structure and Final Site Reclamation

Removal of the T-1 tent structure began on March 29, 1999 and was completed on April 20, 1999. Final reclamation of the site was not started as of the writing of this report.

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6.0 DISPOSITION OF SECONDARY WASTE STREAMS

This section details the characterization of the soils, DU and other wastestreams encountered during the excavation. These wastestreams were managed in a manner consistent with Rocky Flats policies and procedures and the requirements established by the PAM (RMRS, 1998a). A summary of the T-1 waste sample information is found in Appendix D. All waste being sent offsite for disposal will be considered CERCLA waste as the wastes were generated under a CERCLA response action, under the Rocky Flats Cleanup Agreement, and all but uncontaminated field trash is considered low level radioactive waste (LLW). Table 6-1 provides a summary of the T-1 Wastes. This table includes waste types, volumes generated, final and proposed disposition and references to supporting information.

The major wastestreams include:

- Radioactive metals (depleted uranium and other uranium/thorium wastestreams),
- Decanted lathe coolants,
- Cemented cyanide,
- Debris,
- Contaminated soil.

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TABLE 6-1 T-1 SOURCE REMOVAL WASTE/MEDIA DISPOSITION

Vaste Type	Regulatory Classifications	Sample RIN	Packaging	Container numbers (Note secondary overpacks if used are not listed)	Interim Storage	Expected Disposition	Sampling: Analysis/Media	Volume or weight
oil <5,000 CPM, OVA < 25 pm above background)	Not considered waste	98A2112	not packaged	N.A.	Stockpile 1	Returned to T-1	Sampled per section 3.2.1 of the RMRS SAP	1093.4 yd^3
oil ≥ 5,000 but ≤ 10,000 CPM, VA < 25 ppm above ackground)	CERCLA Waste LLM (F001, F002) (LDR compliant)	98A2113	21, B-88s	X09698, X09699, X09700, X09702, X09703, X09704, X09705, X09706, X09707, X09708, X09709, X09710, X09711, X09718, X09719, X09720, X09721, X09722, X09723, X09724, X09725	Stockpile 2 then transferred to B-88s	Envirocare	Per Section 3.3.2 of the RMRS SAP	74.6 yd^3 195,444 lbs
oil >10,000 CPM, OVA < 25 om above background)	CERCLA Waste LLM (F001, F002) (LDR complaint)	98A2114	30, B-88s	X09712, X09713, X09714, X09715, X09716, X09717, X09727, X09728, X09729, X09730, X09731, X09732, X09734, X09737, X09738, X09739, X09741, X09742, X09747, X09748, X09749, X09750, X09751, X09753, X09754, X09757, X09759, X09762, X09763, X09764	T-1 Waste Container Staging Area	Envirocare	Per Section 3.3.2 of the RMRS SAP	106.5 yd^3 280,282 lbs
oil OVA ≥ 25 ppm above ackground)	CERCLA Waste LLM (F001, F002)	98A2116	10, B-88s	X09761, X09752, X09758, X09746, X09755, X09756, X09745, X09743, X09744, X09735,	RCRA Unit 15B	Treatment with T-1 DU or 10x LDR soil exclusion	Per Section 2.2.3 of the RMRS SAP	35.5 yd^3 91,444 lbs
ecanted Lathe Coolants	CERCLA Waste LLM (F001, F002) Low PCBs	98A2106	2, 55 gal	X07938, X07927	T-1 Waste Container Staging Area	Treated on 1/19/99 at Building 891	Per Section 3.3 of the STARMET SAP	110 gal
ecanted Lathe Coolants	CERCLA Waste LLM (F001,F002) PCB Remediation Waste (PCB Liquid)	98A2106	1, 55 gal	X07935	RCRA Unit 15B	Treatment with T-1 DU	Per Section 3.3 of the STARMET SAP	<15 gal

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Waste Type	Regulatory Classifications	Sample RIN	Packaging	Container numbers (Note secondary overpacks if used are not listed)	Interim Storage	Expected Disposition	Sampling: Analysis/Media	Volume or weight
Depleted Uranium	CERCLA Waste LLW Hazardous Waste (F001, F002, D006) PCB Remediation waste	98A2105	See column at right	77 - 55 gallon overpacks: D87702 D88413 D88407 D88417 D87699 D88425 D88387 D88388 D88418 D88414 D88410 D88415 D87710 D88405 D88416 D88412 D88419 D88420 D88406 D92869 D92857 D92858 D92864 D92860 D92861 D92859 D92865 D92868 D92863 D92862 D92854 D92855 D92870 D92853 D92871 D92866 D92852 D93262 D93269 D93264 D93274 D93270 D93271 D93276 D93266 D93282 D93260 D92856 D93259 D93261 D93263 D92867 D93273 D93265 D93275 D93268 D93281 D93272 D93267 D93278 D93279 D93283 D93285 D93277 D93287 D93286 D93288 D93284 D93280 D93462 D93450 D93457 D93461 D93466 D93469 (D87713 & D93473: both are sample returns)	RCRA Unit 15B	DU Treatment Project	Per Section 3.2 of the STARMET SAP	11.7 yd^3 24,490 lbs (includes original 30 gal drum, DU as appropriate)
				48 - 83 gallon overpacks: X09875 X09835 X09837 X09840 X09838 X09850 X09843 X09872 X09867X09868 X09865 X09877 X09841 X09869 X09870 X09894 X09871 X09866 X09845 X09844 X09880 X09874 X09860 X09862 X09884 X09878 X09883 X09853 X09855 X09879 X09887 X09882 X09853 X09854 X09876 X09857 X09886 X09888 X09885 X09864 X09863 X09851 X09893 X09875 X09856 X09890 X09842 X09839				13.1 yd^3 25,976 lbs (includes original 30 and 55 gal drum, DU)
				5 - 85 gallon overpacks: X10374 X10371 X10398 X10375 X10372				3,045 lbs
				1 - 110 gallon overpack: X10058				1,092 lbs
				24 - B12s: X09834 X09833 X09805 X09822 X09821 X09798 X09801 X09809 X09810 X09800 X09804 X09799 X09803 X09806 X09826 X09807 X09828 X09827 X09808 X09832X09830 X09831 X09825 X09824				38.4 yd^3 101,241 lbs
DU - Ingot ("Puck")	AEC Source Material or CERCLA Waste, LLW	not sampled	83 gal	55 gal D93471 overpacked into 83 gal X10906 overpack	RCRA Unit 15B	NTS	not sampled	<0.5 ft^3 163 lbs (includes soil)

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Waste Type	Regulatory Classifications	Sample RIN	Packaging	Container numbers (Note secondary overpacks if used are not listed)	Interim Storage	Expected Disposition	Sampling: Analysis/Media	Volume or weight
Thorium waste	CERCLA Waste LLM (F001, F002, D006) PCB Remediation waste	98A2105	1, 83 gal 1, B-12	X09852 (overpack X11067, IDC 374) X09823 (IDC 374)	RCRA Unit 15B	DU Treatment Project	Per Section 3.2 of the STARMET SAP	0.27 yd³ 497 lbs & 1.6 yd³ 5,090 lbs
HISTORIC SAMPLES UH$_3$ (Natural uranium) and TU (assumed DU tubaloy) Note: some of the UH$_3$ probably contains tritium	CERCLA Waste LLM (F001, F002, D006) PCB Remediation waste	98A2105	1, B-12 2, 55 gal	X09829 (IDC 374) D93476 (separated because tritium concern) D93468 (contains DU and natural U)	RCRA Unit 15B	DU Treatment Project	Per Section 3.2 of the STARMET SAP	2.1 yd³ 5,546 lbs
Cemented Cyanide	CERCLA Waste LLM (F006, F008, D006) Asbestos Containing Material	98A2109	10, 55 gal 1 83 gal	IDC 823: X10401 X10397 X10390 X10399 X10373 X10377 X10376 X10393 X10388 X10382 IDC 325: X09903 (drum lids, rings, sample equip, PPE used in CN tasks)	RCRA Unit 15B	Cemented Cyanide Treatment Project	Per Section 3.5 of the STARMET SAP	2.7 yd³ 6,294 lbs 0.4 yd³ 81 lbs
Debris	CERCLA Waste LLM debris waste (F001, F002) (LDR compliant) PCB Bulk Product waste	98A2117	5, B-88s 1, 55 gal	B-88s: X09736 (sampled), X09733, X09760, X09701, X09726 D87711 (contains pumps, hoses, piping PPE potentially contaminated with T-1 spent lathe coolant)	T-1 Waste Container Staging Area	Envirocare	Per Section 3.4 of the RMRS SAP	17.8 yd³ 16,214 lbs 0.27 yd³ 112 lbs
Project Generated Debris	CERCLA Waste LLW	Not Sampled	1, B-88 4, B-12s	B-88: X09740 B-12s: X09832, X09795, X09796, X09797	T-1 Waste Container Staging Area	NTS	Not sampled	3.6 yd³ 1420 lbs 6.4 yd³ 4,996 lbs
PPE Waste	CERCLA Waste LLW	Not Sampled	1, B-12 5, B-88s	B-12: X09794 B-88s: X09695, X09696, X09697, X11519, X11520	T-1 Waste Container Staging Area	B:12 NTS B-88: shipped to NTS on 2/3/99	Sampling not required	19.4 yd³ 7,934 lbs

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6.1 Radioactive Metals

Most of the radioactive metals removed from T-1 were depleted uranium. Project personnel determined the uranium type and the potential presence of transuranic isotopes using gamma spectroscopy, throughout the project. No wastestreams containing enriched uranium or transuranic isotopes (other than at low, near detection level concentrations) were detected during the T-1 project. The following subsections address both the radiological and chemical characterization of the radioactive metals.

6.1.1 Depleted Uranium

The main DU wastestream has been packaged in 154 containers, both overpack drums and B-12 waste packages as indicated by Table 6-1. Characterization data collected during the excavation phase indicated that there was widespread contamination of the DU with chlorinated volatile organic compounds, polychlorinated biphenyls (PCBs) as well as cadmium. The primary chlorinated VOCs were tetrachloroethene (PCE) and trichloroethene (TCE), and the PCB was Aroclor-1254.

The widespread organic contamination was not anticipated prior to excavation activities. The sampling strategy developed to support the characterization of the DU was based on field segregation of material by physical characteristics or distinct geographic locations, if possible, within the trench (Starmet, 1998). Efforts would then focus on characterization by lot within the DU wastestream. The sampling and analysis plan was not intended to address full characterization of individual drums or waste packages. Segregatable differences in physical characteristics and geographic locations were not apparent during excavation. Since not all drums were sampled for all possible constituents and breakout of DU using field segregation was not possible, breakout of DU by an identifiable lot was not possible.

The analytical approach given in the SAP was to perform a gamma spectroscopy analysis on every container (overpack drum or B-12 waste box) and metals, VOCs and SVOCs on every fifth container filled. As the first drums of DU were removed it became apparent that widespread VOC contamination existed. As such, the VOC analysis was immediately increased from every fifth to every container. After approximately one third of the containers were sampled, oily material was observed on samples of DU. This material was analyzed for PCBs which were subsequently confirmed present. At this point it was decided to analyze samples for PCBs from

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all new drums being removed from T-1 as well as on some of the samples previously submitted to the laboratory. PCBs were detected in most of the samples at widely varying concentrations. Relatively high levels of metals were detected in some of the drums. It was decided that if total metal concentrations could exceed the TCLP thresholds, then the laboratory would perform TCLP metals on the affected samples. Of the approximately thirty-one waste containers sampled for metals, six drums exceeded the TCLP thresholds for cadmium. There was no apparent relationship of the cadmium concentration variability with any other characteristic of the waste.

Extreme variability in chlorinated VOC, PCB and cadmium concentrations in DU samples has major waste management and disposal consequences. It seems reasonable to assume that much of the variability of the organic contaminants is attributable to the amount of "oil residue" that was present in some of the DU material being sampled, and that the amount of residue may be variable within an individual drum. Therefore, it would be difficult to accurately determine VOC and PCB concentration levels in a drum based on one sample, from the drum. Therefore, the entire chips and turnings based DU wastestream will be characterized as a lot, not on an individual drum by drum basis. The following characterization is a result of the lot based characterization approach.

The DU wastestream is considered contaminated with chlorinated volatile organic compounds that are typically considered F001 and F002 solvents based on historic use at Rocky Flats. In addition, the waste code D006 has been applied because approximately 20% of the drums sampled exceed the TCLP thresholds for cadmium. Finally, the waste is considered a bulk PCB remediation waste under the Toxic Substances Control Act (TSCA).

This wastestream will require treatment prior to disposal. Final treatment must address treatment of the RCRA underlying hazardous constituents (UHCs) reasonably expected in the waste. This must include numerous semivolatile organic compounds (SVOCs), PCBs addressed as UHCs and any other constituents reasonably expected in the waste stream. Sample results for this wastestream are all contained in RIN 98A2105.

There is one exception to the overall DU chemical characterization. A DU ingot or "puck" was uncovered during the excavation. This material was solid and did not appear to have been machined. This material was placed in a 55-gallon drum (D93471), inerted or packed with clean soil and subsequently overpacked into a 83-gallon drum (X10906). The volume of the DU puck

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is less than $0.5ft^3$. This material was not sampled because the material was positively identified by one of the project RCTs familiar with the process of generating DU ingots or "pucks". In addition, sampling solid DU would have been extremely challenging. Because of its massive nature this waste is not considered pyrophoric, and is not considered a hazardous waste or PCB waste, because it has not been machined, so contamination is unlikely. Also cadmium presence is unlikely as the ingot was not a finished product and did not appear to have been plated; a probable source of the cadmium contamination. The ingot is considered low level radioactive waste or source material under the Atomic Energy Act.

On several instances Am-241 was detected in DU samples submitted for gamma spectroscopy analysis. The analysts providing gamma spectroscopy services were not convinced that the material that they were identifying as Am-241, was in fact that isotope. They observed evidence of the characteristic X-rays of tungsten, which, if present could interfere with their ability to quantify Am-241. Data was reported as Am-241, however letters accompanying the data submittal indicated their uncertainty. Using a combination of X-ray fluorescence to identify tungsten and radiochemical analysis of Am and Pu isotopes, the potential presence of significant Am-241 (e.g., anything more than background level contamination) was eliminated. A sample composited from five DU samples did show the presence of Pu-239/240, though at a relatively low 16 pCi/g.

A more complete description of the gamma spectroscopy Am-241/tungsten anomalies is contained in the Gamma Spectroscopy data packages for RIN 98A2105.

Two drums (D87713 & D93473) contain T-1 DU and soil sample returns that were returned after analysis from onsite laboratories. Plastic sample jar lids were removed (part of debris wastestream) and the samples placed into one of two 55 gallon drums. If the sample could not be removed from the glass jar, the sample was broken open in the drum, therefore the drums contain glass shards in addition to the DU and soil. The DU was inerted with the returned soil samples and additional clean soil, as required.

Radioactive metals other than DU are described in the following two subsections.

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6.1.2 Thorium

Through the use of gamma spectroscopy it was determined that some of the radioactive material removed from T-1 was not DU or DU contaminated. Two samples (a regular and duplicate) used to characterize a drum of radioactive material placed into an 83-gallon overpack indicated that the drum was contaminated by Thorium-232 (Th-232) through identification of its daughter products including Actinium-228 (Ac-228). The samples 98A2105-023 and 98A2105-024 were used to characterize this drum (X09852). Considering that the material is approximately 40 years old, the activity detected for Actinium-228 would approximate that of the Th-232 parent material. This would be approximately 20,000 pCi/g Th-232 for the material in drum X09852. The relationship between Ac-228 and Th-232 was confirmed using the computer software RADDECAY (Grove engineering, 1987).

A B-12 (number X09823) also contains Th-232 waste and unlike the drum described above contains DU as well. The in-process checklist used during the box filling indicates that the B-12 probably contains the contents of two non-intact drums and soil. The sample log clearly indicates that two distinct materials made up the sample from the B-12 (Sample number 98A2105-040) and the results confirm both the presence of thorium and DU. As a result, it is reasonable to assume that the B-12 contains both a thorium (Th-232) and a DU wastestream.

The thorium waste is also contaminated with PCE, TCE and PCBs similar to that of the DU. Significant cadmium was not detected in the drum (X09852) but was not sampled for in the B-12 (X09823). Since this information is absent but possible, it is assumed that the waste contains cadmium and will be coded as D006 as well.

6.1.3 Natural Uranium

A B-12 waste box (X09829) contains the contents of old "historic" sample bottles described in Section 3.4.2. As the section indicates the sample jars make up a very small proportion of the contents of the B-12, with the remaining volume containing soil. The sample jars contain both natural and what is assumed to be DU (the "tuballoy" sample). No samples were collected from the jar identified as containing tuballoy since this material was assumed to be DU. The samples collected from the other original (historic) sample bottles are 98A2105-187, 203, 204, 207. These samples contained PCE, however no PCBs or cadmium above TCLP thresholds was detected. As noted above, the tuballoy itself was not sampled, and therefore the absence of PCBs or cadmium cannot be eliminated. Therefore, the same chemical characterization used for the DU has been applied.

Additional historic sample bottles were contained in the 5-gallon "pail" that was encountered during backfilling operations in December, 1998. A total of 5 historic sample jars were contained in the pail. Three of the five sample bottles were placed into one 55 gallon drum (D93468). One sample (99A5024-001) was collected from a historic sample jar which had little identification information on it. The other two sample jars indicated U-238 (probably DU) and were not sampled. The result indicated the sampled material had isotopic ratios similar to natural uranium. Therefore, container D93468 is assumed to have both natural and DU material in it.

The two remaining historic sample jars had identification markings indicating that the material was uranium hydride. Both samples were analyzed by gamma spectroscopy in their original sample jars (overpacked in new double plastic bags). The results were consistent with "natural uranium" using the isotopic uranium rations and the tolerances established by the project. After analysis, these samples were placed in a 55 gallon drum (D93476), covered with inerting soil and broken open to inert in the soil.

After the second jar was broken open, an alarm sounded from a tritium monitoring instrument used to monitor the evolution. As discussed in Section 3.4.2, tritium was likely to have been a component of the uranium hydride. The total concentration (activity) of tritium present in the material has not been determined. Tritium should be evaluated prior to treatment of this material. As a precaution, all radioactive metal waste described as containing "natural uranium" should be handled as though it contains tritium unless tritium can be eliminated through direct analysis.

6.2 Decanted Lathe Coolants

What appeared to be lathe coolant was decanted from a number of intact drums removed from the trench. The lathe coolant was segregated in accordance with the Starmet SAP. Two 55-gallon drums were filled with what appeared to be an aqueous phase liquid (X07938, X07927), while one drum (X07935) was filled with an organic phase liquid. Analytical results confirmed the presence of chlorinated VOCs and PCBs in the lathe coolant, while significant levels of inorganic contaminants (metals) were not detected. Because of the presence of PCE, TCE and

PCBs, this wastestream was considered to be an F001, F002 hazardous waste and also a TSCA PCB Remediation Waste (PCB liquid), for offsite waste disposition purposes.

Samples analyzed at the Rocky Flats 559 Laboratory showed elevated plutonium results using the laboratories gram per liter (g/L) procedure. No Americium-241 (Pu-241 progeny) was detected from collocated samples analyzed by gamma spectroscopy; indicating questionable g/L Pu results. After consultation with the 559 laboratory it was determined that the g/L procedure does not separate Pu and U. Hence, elevated U levels would likely cause artificially high levels of Pu to be reported, as was most likely the case. Considering this, and the fact that the Pu-241 progeny was not detected by gamma spectroscopy, the presence of Pu in the lathe coolant was ruled out. The samples used to characterize the decanted lathe coolant are contained in RIN 98A2106. Appendix D lists the analytical results and supporting information used to characterize the lathe coolant.

On January 20, 1999 the two drums containing aqueous phase liquids were treated at the Rocky Flats Consolidated Water Treatment Facility (CWTF). Treatment alternatives are currently being evaluated for Drum X07935 which contained the organic phase liquid. It is possible that this drum may be treated with the DU wastestream.

6.3 Cemented Cyanide

Ten 55-gallon drums of unsolidified cemented cyanide waste were exhumed from the trench. Several issues existed regarding the classification of this waste. Appendix D includes a letter formalizing a change in classification from what was originally assumed in the PAM.

Samples were collected from each of the ten drums for gamma spectroscopy and total cyanide analysis. All results indicated low level uranium contamination and significant levels of cyanide (0.51 - 5.3 weight %). Most of the drums appeared to contain asbestos fibers; samples from two drums were analyzed for asbestos and both contained significant asbestos (15 and 25% by volume). Four samples were collected from three of the drums (this included one duplicate) and were analyzed for VOCs/SVOCs, the full TCLP list, reactive sulfide, reactive cyanide, corrosivity, and isotopic Pu, Am, U, as well as additional gamma spectroscopy. These four samples appeared to be representative of the entire wastestream. A summary of the analytical results follows:

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- No VOCs or SVOCs were detected,
- All samples exceeded TCLP thresholds for cadmium (829-1,200 mg/L),
- No other TCLP thresholds were exceeded,
- pH was in the range of 12.4-13.2,
- Reactive Sulfide was undetected,
- Reactive Cyanide: Three of four samples reported as undetected. One sample reported as 0.3 mg/kg reactive cyanide.

The original, complete data set collected to characterize this waste can be found in the K-H Analytical Services Division vault under report Identification Number (RIN) 98A2109. Table 6-2 contains a summary table of the analytical results.

As the PAM states, the original cyanide generation process could not be established with full confidence. As a result, it was originally planned to rely on the waste characteristics to determine if it was hazardous waste or not. After a more thorough evaluation (see Appendix D) the generation process was essentially determined to be a listed electroplating process. The applicable listings are F006 and F008 and are defined as "Wastewater treatment sludges from electroplating operations...", and "Plating bath residues from the bottom of plating baths from electroplating operations where cyanides are used in the process", respectively. Though there are no Land Disposal Restriction (LDR) implications, the waste code D006 is also being added to the cemented cyanides. This was not addressed in the reclassification letter described above but is appropriate as the waste exceeds the TCLP standard for cadmium.

TABLE 6-2 SUMMARY OF CEMENTED CYANIDE ANALYTICAL RESULTS

			All Radionuclides in pCi/g										
					U-235/238 Mass Ratio		TCLP	Total Cyanide	Reactive Cyanide		Asbestos		
Sample Number	Location	Description	U-238	U-235	(%)	Am-241	Exceedence	(weight %)	(ppm)	pH	(vol %)	VOCs	SVOCs
98A2109-001	X10401	Top layer is white/grey/yellow. Bottom layer is grey/green + slightly red/brown. Pasty w/ fibers	117.0	2.55	0.34	11.3U	Cd @ 829 mg/l	2.13	0.3	12.4	25	ND	ND
98A2109-003	X10397	Tan damp material, no liquid present	84.8	2.42	0.44	10.8U	Cd @ 1,040 mg/l	1.85	ND	12.9	15	ND	ND
98A2109-004 (duplicate of 003)	X10397	Tan damp material, no liquid present	55.6	3.12	0.87	11U	Cd @ 1,200 mg/l	3.39	ND	13.2	Fibers Visible	ND	ND
98A2109-006	X10390	Off-white material/light gray at depth. Liquid present.	91.0	3.44	0.59	5.44U	Cd @ 972 mg/l	2.25	ND	12.8	Fibers Visible	ND	ND
98A2109-008	X10399	Off-white material. No liquid present. Pasty with fibers	16.0	0.71	0.69	4.53U	Not tested	2.30			Fibers Visible		
98A2109-009	X10373	Off-white matl w/ brown liquid present on surface. Saturated paste. pH = 13	21.6	1.09	0.78	4.61U	Not tested	2.40			Fibers Visible		
98A2109-010	X10377	Hard brown/gray material. Wet pastes below surface.	59.9	0.986U	0.00	5.92U	Not tested	5.30			Fibers Visible		
98A2109-011	X10376	Tan wet paste. Liq on surface & in material. pH=13.	40.6	1.31	0.50	1.26U	Not tested	2.80			Fibers Visible		
98A2109-012	X10393	Hard tan material, greenish colored below surface.	8.1	0.193U	0.00	1.26U	Not tested	2.00					
98A2109-013	X10388	Dark green to off-white hard materials	26.4	0.944	0.56	1.18U	Not tested	0.54			Fibers Visible		
98A2109-014	X10382	Light tan/off-white wet paste	81.8	2.38	0.45	1.95U	Not tested	0.51			Fibers Visible		

6.4 Excavated Debris

Other than drum carcasses very little debris was encountered during the T-1 excavation. Deteriorated drum carcasses (fragments), drum lids and rings were typically removed as practical and visually verified free of chips or turnings so that they would be considered non-pyrophoric, and free liquids (i.e., oils). This material was then placed in B-12 or B-88 type waste boxes. The other types of debris encountered included a few pieces of pipe, a small volume (<1 ft^3) of some type of sandpaper and cardboard containers identified as "ice cream cartons" in the field. These cardboard containers were apparently used to hold DU floor sweepings from Building 444. There were six B-88's and three B-12's filled with debris. Since very little debris was encountered, few samples were collected. Only one full chemical suite sample was collected, along with a few additional gamma spectroscopy samples. All samples showed evidence of DU contamination. The full suite sample was collected from the cardboard "ice cream cartons". The sample contained PCE at 23 ug/kg, (F001, F002 but below the current LDR levels), PCB (Aroclor-1254) at 730,000 ug/kg, and various RCRA metals including cadmium, all well below the TCLP thresholds. As such, the waste is considered an LDR compliant mixed hazardous waste with the following RCRA codes, F001 and F002. In addition, the waste is considered a mixed PCB Remediation waste under TSCA. Since much of the debris is rusty metal fragments, it may not be practical to use the RCRA debris standard to exit the RCRA hazardous waste regulations.

The sample of the cardboard "ice cream cartons" is probably a "worst case" sample as it contained DU, was very porous, and hence was able to absorb contaminants better than the typical metal drum fragment. All debris sample results are contained in the project files for RIN 98A2117.

6.5 Project Generated Debris

Several waste boxes of crated debris contain material that did not originate from the trench. Specifically, boxes X09740, X09832, X09795 and X09796 contain items like PPE, plastic liners, empty 1 gal paint cans (used to transport T-1 samples), various metal and wood components used within the tent structure, a mineral oil pump, PM-10's air monitors with motor assemblies, air filters from the heavy equipment, wooden handles form shovels and HEPA cartridges from full face respirators, etc. These materials are considered by project waste generation personnel to be CERCLA and LLW only, as they are not contaminated by RCRA or TSCA constituents.

Samples were not collected of this debris, but the debris is consistent with typical materials used in radiologically controlled areas that cannot be economically free released because of the potential for low level radionuclide contamination in inaccessible or difficult to survey areas.

6.6 Soil

Soil not returned to T-1 was segregated using radiological and VOC field screening techniques into the categories described in Section 3.1. Analytical results from ten B-88s containing soil with OVA readings at > 25 ppm contained chlorinated VOCS (primarily PCE and TCE) at concentrations up to 51 mg/kg, and aroclor-1254 up to 16 mg/kg. As such, the waste is considered a non-LDR compliant mixed hazardous waste with RCRA codes F001 and F002. Because all measured PCB concentrations are below 50 ppm this wastestream is not regulated under TSCA. This material is considered one lot, and will require treatment prior to disposal, to address the F001 and F002 constituents. The data used in this analysis is contained under RIN 98A2116. Table 6-3 provides summary analytical information for soils that were screened to contain > 25 ppm on the field OVA.

Twelve gamma spectroscopy and four full suite chemical samples were collected from fifty-one B-88s containing soil with OVA reading at < 25 ppm. This wastestream was originally anticipated to be LLW, suitable for disposal at NTS. However, one sample from this lot of B-88s contained a positive detection of PCE at 24 ug/kg, and Aroclor-1254 (a PCB) at 650 ug/kg. As such, the waste is considered an LDR compliant mixed hazardous waste with RCRA codes F001 and F002. In addition, the waste is considered a mixed PCB Bulk Remediation waste under TSCA. This material is considered one lot, and will not require treatment prior to disposal. The data used in this analysis is contained under RINs 98A2113 and 98A2114. Table 6-4 provides summary analytical information for soils that were screened to contain < 25 ppm on the field OVA.

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TABLE 6-3 SUMMARY OF ANALYTICAL RESULTS FOR SOILS CONTAINING > 25 PPM ON THE FIELD OVA

			All Rad in pCi/g		mass ratio		All Chemicals in mg/kg			
RIN	Container	Container Type	U-238	U-235	235/238	AM-241	PCE	TCE	PCB-1254	SVOC
98A2116-001	X09761	B-88	334.00	3.53	0.16	ND	0.84 B	0.045 J	0.97	low detections of few SVOCs
98A2116-002	X09752	B-88	1,300.00	7.36	0.09	ND	O.32	ND	1.1	low detections of few SVOCs
98A2116-003	X09758	B-88	708.00	4.23	0.09	ND	0.46	ND	2.5	low detections of few SVOCs
98A2116-004	X09746	B-88	796.00	14.00	0.27	ND	0.42	ND	1.8	low detections of few SVOCs
98A2116-005	X09755	B-88	245.00	0.00	0.00	ND	0.27	ND	0.19	low detections of few SVOCs
98A2116-006	X09756	B-88	1,470.00	18.50	0.20	ND	0.82	ND	1.6	low detections of few SVOCs
98A2116-007	X09745	B-88	466.00	4.53	0.15	ND	0.47	ND	1.3	low detections of few SVOCs
98A2116-008	X09743	B-88	92.40	0.00	0.00	ND	0.067 J	ND	0.45	low detections of few SVOCs
98A2116-009	X09743	B-88	148.10	2.45	0.26	ND	0.140 J	ND	9.5 D	low detections of few SVOCs
98A2116-010	X09744	B-88	3,980.00	45.10	0.18	ND	51 D	0.130 J	16 D	low detections of few SVOCs
98A2116-011	X09735	B-88	230.00	5.27	0.36	ND	0.63 B	ND	ND	Big TICS
98A2116-012	X09726[1]	B-88	137.00	1.28	0.15	ND	0.73 B	ND	0.53	Big TICS

Notes:

[1]Container X09726, was originally sampled as soil. However, this container was subsequently filled with debris and as such is considered a debris wastestream.

B = detected in blank

J = result below instrument detection limit, estimated value

ND = not detected

TICS = Tentatively identified Compounds

TABLE 6-4 SUMMARY OF ANALYTICAL RESULTS FOR SOILS CONTAINING < 25 PPM ON THE FIELD OVA

ɔoil > 10,000 CPM			Gamma Spectroscopy (pCi/g)		mass ratio	Radiochemcial (pCi/g)		Total VOCs (ug/kg)			Total SVOCs (ug/kg)	Total PCBs (ug/kg)	TCLP (mg/L)					Reactives (mg/kg)		
RIN	Location	Container Type	U-238	U-235	235/238	AM-241	Pu-239	PCE	TCE	xylenes		Aroclor-1254	VOCs	SVOCs	pesticides	herbicides	metals	Cn-	Sulfide	pH
8A2114-001	X09759	B-88	670.00	3.91	0.09	0.13	1.39	24.0	6 U	6 U	low SVOCs	650	0.048 mg/L PCE, 0.017 mg/L TCE J	non-detects	non-detects	non-detects	< TCLP	0.50 U	60	8.3
3A2114-003	X09741	B-88	1,250.00	6.51	0.08															
3A2114-004	X09714	B-88	509.00	9.45	0.29															
3A2114-005	X09737	B-88	306.00	1.90	0.10															
3A2114-006	X09716	B-88	547.00	10.90	0.31	0.29	2.74	1.1U	1.1 U	2.2 U	low TICs	not analyzed	carbon tet 0.0562*	non-detects	non-detects	non-detects	< TCLP	-0.0388 U	5.39 J	7.84
3A2114-008	X09718	B-88	70.50	1.85	0.41	0.53	0.14	1.2 U	1.2 U	2.0 J	low TICs	not analyzed	carbon tet 0.0469*	non-detects	non-detects	non-detects	< TCLP	-0.0336 U	0.173 J	8.35
oil 5,000 - 10,000 CPM																				
3A2113-001	TR00698	stockpile	782.00	8.02	0.16															
3A2113-002	TR01598	stockpile	600.06	4.80	0.12															
3A2113-003	TR02098	stockpile	43.42	0.63	0.23															
3A2113-004	TR02098	stockpile	31.59	0.62	0.30															
3A2113-005	TR02998	stockpile	24.80	0.73	0.46															
3A2113-006	X09722	B-88	170.00	2.36	0.22	0.31	1.03	1.1 U	1.1 U	2.2 U	low TICs	not analyzed	carbon tet 0.0417 J*	non-detects	non-detects	non-detects	< TCLP	-0.0264 U	0.472 J	8.04

Notes

B = detected in blank

U = detection limit

J =result below instrument detection limit, estimated value

TICS = Tentatively identified Compounds

In samples 98A2114-006, 008 and 98A2113-006, carbon tetrachloride was detected in the TCLP leachate. However, this compound was also detected in the corresponding TCLP blanks at approximately the same concentration and was not detected in the collocated samples analyzed for total VOCs. Therefore, this contaminant can only be considered a result of internal laboratory contamination, and is not reflective of the waste.

7.0 DATA QUALITY ASSESSMENT

Data used in making management decisions for waste management remedial actions must be of adequate quality to support the decisions. Adequate data quality for decision-making is required by applicable RMRS and K-H corporate policies (RMRS, 1998d, §6.4 and K-H, 1997, §7.1.4 and 7.2.2), as well as by the customer (DOE, RFFO; Order O 414.1, Quality Assurance, §4.b.(2)(b)). Regulators and the public also expect decisions and data that are technically and legally defensible. Verification and validation of the data ensure that data used in designing the project -- addressing both environmental risk and potential waste liabilities -- are usable and defensible.

Data quality objectives of the project were achieved based on the Data Quality Assessment (DQA) provided herein, which includes details of the Verification and Validation performed on the project data. A summary of the DQOs and the corresponding decisions is given in Table 7-1.

Details on the data validation, relative to data qualifications and completeness of the process, are given in Section 7.3.

Real-time decisions made in the field during remediation of the trench were based on "Form-1" data faxed directly from the lab(s). Thorough data validation could only be performed after data were collected into packages and submitted to the data validator. Fundamental aspects of data verification critical to real-time decisions, such as sample traceability, were performed in the field by the sample manager.

7.1 Verification of Results

Verification ensures that data produced and used by the project are documented and traceable per quality requirements. Generally, verification consists of reviewing the data to determine whether

- Chain-of-Custody was intact from initial sampling though transport and final analysis;
- preservation and hold-times were within tolerance;
- selected samples underwent analysis at Utah Certified labs (for WAC compliance), as appropriate; and
- format and content of the data is clearly presented relative to goals of the project.

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TABLE 7-1 TRENCH-1 SUMMARY OF SAMPLE TYPES & DQOS

Sample Type	DQA, V&V completed	DQO	Decision
final excavation surfaces (floor & sidewalls)	Yes	verify that cleanup target levels stated in the associated PAM were met	Excavation surfaces are below regulatory thresholds (PAM); excavation and backfill completed
depleted Uranium	Yes	determine types of radioactive materials and quantities, as well as any hazardous constituents that would constitute mixed waste streams for suitable treatment/recycling design	Results confirm majority DU, but also helped segregate thorium and natural uranium; waste is also CERCLA LLM (VOCs, Metals) & TSCA (PCBs); waste destined for treatment (TBD)
Stockpile (<5k cpm)	Yes	confirm acceptable levels of COCs for returning soil to excavation, complementary to field monitoring	soil contaminants below applicable RFCA action levels (soil was used as backfill)
Stockpile (5k - 10k cpm)	Yes (partial)	determine whether soil is eligible for return to trench, per types & quantities of COCs present	stockpile contaminated (CERCLA, LLM); packaged for offsite shipment (see Table 6-1)
Stockpile (>10k cpm); organic vapor < 25ppm	Yes (partial)	determine types of rad/haz materials and quantities for suitable treatment/disposal options	packaged for offsite dispostion (CERCLA, LLM)
liquid wastes	Yes (gamma spec only)	verify that liquid waste can be treated at the onsite CWTF	some liquid waste accepted by CWTF; remainder to be treated w/ depleted U
VOC contaminated soils; organic vapor >25ppm	Verified only	determine types of rad/haz materials and quantities for suitable treatment/disposal options	CERCLA, LLM; (see Table 6-1)
debris (from excavation)	Yes (partial)	determine types of rad/haz materials and quantities for suitable treatment/disposal options	CERCLA, LLM; PCB Bulk Product Waste
geotechnical	Not Required	comply with minimal WAC requirements @ TSDF (Envirocare)	WAC Compliance established
isotopic (actinides)	Yes	verify gamma-spec method relative to actinide types/quantities	Gamma-spec results are acceptable
cemented cyanide	Pending	To determine types of rad/haz materials and quantities.	CERCLA, LLM; Asbestos Containing Material
tritium	Yes	To determine presence/absence of tritium	Tritium present, probable in some material

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In addition to the criteria noted above, verification of the T-1 data also included additional checks sometimes acknowledged as within the "validation" category, depending on the type of analysis:

- surrogate recovery
- MS/MSD recovery
- calibrations
- blanks
- sample preparations
- other QC

For an integrated evaluation of the data quality, results of the verification are collectively discussed with validation in Section 7.3.

7.2 Validation

Validation consists of a technical review of the data, or portion of the data, so that any limitations of the data relative to project goals are defined, and the associated data are qualified (caveated) accordingly. Data were validated relative to the Precision, Accuracy, Representativeness, Completeness, and Comparability (PARCC) parameters described in the next section. Validation is also currently performed on a site-wide basis at ~25% frequency by K-H Analytical Services Division. Satisfactory validation at this frequency indicates that the subcontracted labs are operating competently relative to industry-wide standards, and more specifically, that sample custody and analytical procedures are implemented under defined quality controls. Sitewide data validation coupled with annual lab audits provides the inference that all analytical and radiochemical results not specifically validated, are represented by the percentage that is validated. Original V&V packages for the T-1 Project are managed and filed by the K-H Analytical Services Division, Building 881.

Several project-specific audits by the project's QA coordinators were also performed before and during the project to ensure that critical controls were in place prior to data gathering activities in the trench. These audits, or assessments (RMRS Surveillance No. RMRS-98-0116, -0117, -0118, -0130, -0120, and -0132), addressed various project processes, including records management and measurement equipment, and documented the status quo relative to the project's (and the site's) Quality requirements. Disparities noted in the program were corrected prior to any negative impacts on the project or related data.

Verification and validation of the project's data, given in Sections 7.1 through 7.3, included use of the following protocols and guidance:

- Rocky Flats Administrative Procedure 2-G32-ER-ADM-08.02, Evaluation of ERM Data for Usability in Fnal Reports;
- EPA, 1994. USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA 540/R-94/013
- EPA, 1994. USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, EPA 540/R-94/012
- EPA, 1996. EPA QA/G-9. Guidance for Data Quality Assessment, Practical Methods for Data Analysis

7.3 PARCC Parameters

The following Subsections detail the PARCC evaluation performed on the T-1 data set.

7.3.1 Precision

Precision is a measure of the reproducibility of results. Typically, precision is evaluated from 2 perspectives:

1) an analytical standpoint, i.e., reproducibility within the lab that reflects analytical precision inherent to the method; and,
2) an overall project standpoint, which combines both analytical precision and reproducibility of the field sampling method and specific matrix type.

Precision may be expressed quantitatively by at least two functions. The most typical measure for nonradiolgical analyses is the relative percent difference (RPD) term, whereas, because of the stochastic nature of radioactivity, a statistical measure is better suited for evaluating radiological reproducibility -- the duplicate error ratio (DER).

$$RPD = \frac{|C_1 - C_2|}{(C_1+C_2)/2} * 100$$

where:

C_1=first sample
C_2=duplicate sample

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$$DER = \frac{|C_1 - C_2|}{\sqrt{(TPU^2_{C1} + TPU^2_{C2})}}$$

where:

TPU = total propagated uncertainty

note: counting error, also known as the 2-sigma error, may be used in lieu of the TPU as a conservative measure; if precision exceeds the critical value of 1.96, TPU should be used in the equation prior to qualifying precision of the measurements in question.

The DQO for field duplicate frequency (for sample collection and analysis) was attained for all contaminants of concern and matrix types; results from the precision evaluation are discussed below and summarized in Table 7-2.

Radiological Surveys (RFETS-specific procedures)

Precision of the radiological instrumentation was satisfactory based on periodic (daily) tolerance charting of source measurements. Any measurement that exceeds defined tolerance limits (±20%) results in corrective action (e.g., instrument repair or replacement) before measurement of real samples. Tolerance specifications may be found in the applicable *Radiological Safety Practices*.

Job-site Gamma-Spectrometry

The most significant indicator of satisfactory precision of the project -- gained through performance evaluation/validation vs. systematic validation alone --resides in the favorable comparison between the RFETS project-specific results and the same samples reanalyzed by the CDPHE (12 total). All split samples were within predefined tolerance, expressed as the DER, which is an industry standard measure for evaluating whether two samples are significantly different. "Significance" is defined in the statistical sense and indicates that, with 95% confidence, the samples were derived from the same population, and therefore are not significantly different from one another. CDPHE results are included in Appendix C.

Laboratory Alpha Spectrometry

Data validation revealed no problems with precision relative to alpha spectrometry.

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	RIN-EVENT	Location	VOCs			SVOCs	PCBs	Cyanide	Asbestos	Metals									Job-site gamma-spec			Lab 559 isotopics (3)	
			Toluene	PCE	TCE	(general)	Aro-1254	Total	Total	Arsenic	Barium	Cadmium	Chromium	Lead	Selenium	Silver	Hg	U-238	U-235	AM-241	Am-241	Pu-239/240
	(sample ID)		Precision within tolerance? (<20% liq, <30% solid)[4]															Precision within tolerance? (DER<1.96)				
Excavation Bounds	98A2111-014	EB0203E																				
	98A2111-015	EB0203E	YES	YES	YES	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	YES	YES	YES	NA	NA
	98A2111-027	EB0406																				
	98A2111-028	EB0406	YES	YES	YES	NA	YES	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	YES	YES	YES	NA	NA
	98A2111-037	EB0308																				
	98A2111-038	EB0308	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	YES	YES	YES	NA	NA
Depleted U	98A2105-023	X09852																				
	98A2105-024	X09852	YES	YES	YES	YES	NA	NA	NA	YES	YES	YES	YES	YES	YES	YES	NA	NA (1)	NA (1)	NA (1)	NA	NA
	98A2105-043	X09862																				
	98A2105-044	X09862	YES	YES	YES	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	YES	YES	YES	NA	NA
	98A2105-063	X09888																				
	98A2105-064	X09888	YES	YES	YES	NA	NA	NA	NA	YES	YES	YES	YES	YES	YES	YES		YES	YES	YES	NA	NA
	98A2105-099	D88412																				
	98A2105-100	D88412	YES	YES	YES	NA	[redacted]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	YES	YES	YES	NA	NA
	98A2105-110	D92864																				
	98A2105-111	D92864	YES	YES	YES	NA	YES	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	YES	YES	YES	NA	NA
	98A2105-152	D93281																				
	98A2105-153	D93281	YES	YES	YES	YES	YES	NA	NA	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	NA	NA
	98A2105-162	D93277																				
	98A2105-163	D93277	YES	YES	YES	NA	YES	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	YES	YES	YES	NA	NA
	98A2105-186	D93288																				
	98A2105-187	D93288	YES	YES	YES	YES	YES	NA	NA	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	NA	NA
	98A2105-190	X09822																				
	98A2105-191	X09822	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	YES	YES	YES	YES (2)	YES (2)
Cyanide	98A2109-003	X10379																				
	98A2109-004	X10379	NA	NA	NA	NA	NA	[redacted]	YES	YES	YES	YES	YES	YES	YES	YES	NA	YES	YES	YES	NA	NA
Soil Stockpile (<5000cpm)	98A2112-003																					
	98A2112-004		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	YES	YES	YES	NA	NA

(1) Th was reproducible
(2) Composite samples that include the associated grab
(3) Lab isotopic analysis, when compared w/ Gamma-spec results, were repeatable relative to action levels & project decisions.
(4) rows with stippled pattern are the real samples; precision "Pass/Fail results are tabulated per duplicate sample ID.

Table 7-2. Summary of Precision Compliance with Project DQOs.

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VOC (EPA 8260)

Laboratory precision was indeterminate for several samples within RINs 98A2105, 98A2111, 98A2112 due to nonexisting MS/MSD information. However, the overall precision for VOC analyses within the project, and for all sample types, was satisfactory based on acceptable RPD values for all field duplicate results.

SVOC (EPA 1311/3510/8270)

SVOC results were validated at a frequency greater than the DQOs; all results were within precision tolerances.

PCBs (EPA 8081)

One of five (20%) PCB duplicate samples failed to meet quality objectives for repeatability. However, because these samples indicate a waste stream with PCB concentrations in excess of regulatory thresholds (numerous samples exceeded 50 ppm in DU), the levels of variation noted causing the precision tolerance to be exceeded (~10ppm) are insignificant. Therefore, no qualification of data is warranted based on the relatively low levels of variation noted, especially within the context of a PCB contaminated waste stream.

Metals (TCLP, Total, and Mercury; EPA 1311/6010 & 7470)

TCLP Cadium results are qualified as estimates only due to lab duplicate results out of tolerance; those samples (depleted U) qualified are: 98A2105-38, -51, -121, -127, -133, -139, -146, -152, -153, -159, -166, -167, and -173 (13 samples).

Cyanide (EPA 9010)

Precision of cyanide results representing the remediation effort, i.e., the excavation floor and walls, was adequate based on the repeatability of all (6) sample results at levels well below regulatory action levels (29 mg/kg maximum << RFCA action level of 154,000 mg/kg).

Overall cyanide precision was unacceptable based on the only field duplicate evaluated, which yielded an RPD in excess of 50%. However, because all cyanide samples yielded results well above action levels (i.e.,>20 times the action level of 590 ppm, LDR for Total Cyanide), qualification of the results does not impact the waste management decision for the waste stream in question (DU).

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Asbestos (EPA 40 CFR 763, Subpart F, Appendix A)
One duplicate sample was in agreement with the associated real, as both exceeded the 1% (by volume) action level for asbestos. Asbestos was identified in both samples of cemented cyanide waste submitted for analysis and grossly quantified mesoscopically (i.e., without a microscope). RPD values were not calculated, as both samples clearly exceeded action level. Like many of the other contaminants of concern for this project, concentrations of asbestos were relatively high where samples were acquired, and thus the potential for false negatives due to imprecision are essentially nil.

7.3.2 Accuracy

Accuracy is a measure of how closely an analytical or survey result corresponds to the "true" concentration or activity in a sample. Systematic uncertainties that affect accuracy, also known as bias, are also included under this section.

Radiological Surveys (RFETS-specific procedures)
Accuracy of radiological surveys is satisfactory based on annual calibrations of instrumentation and daily source checks that must perform within specified tolerances (±20%) as specified in the *Radiological Safety Practices.*

Job-site Gamma-Spectrometry
The accuracy of gamma-spectrometry is corroborated through two varieties of validation implemented for the project: systematic validation, and more importantly, performance validation -- i.e., use of performance evaluation (PE) samples to validate the entire gamma-spec measurement system relative to the site-specific matrix types and radiological levels of interest.

The performance evaluations were performed before real sample analyses were measured by the gamma-spec system as a prerequisite. Three (3) PE samples were acquired by the project, from an independent Standards Laboratory, to evaluate the gamma-spec vendor's capability to perform within quality requirements. The PE samples were designed to represent the most important sample types (matrices) of interest for the project, as well as qualify the measurement systems' accuracies through a range of energies and activities. The PE samples, which were blind to the vendor, consisted of

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1) a common industry standard spiked with 9 different isotopes, with energy ranges (in kV) and activities (dps) within ranges representative of those isotopes expected on site;
2) a soil sample spiked with actinides common to RFETS -- spike values were at relatively low activity levels; and,
3) a relatively low (activity) spike value of Am^{241} within a depleted Uranium matrix (high activity), to ensure the system's capability of detecting Am^{241} in samples consisting primarily of depleted U (a combination which typically presents interferences in Am^{241} identification/quantification).

All measurement systems used by the vendor met the performance criteria set forth as a prerequisite to project start-up; the performance criteria consisted of yielding measured results (average value of 3 replicates) to within ±20% of the true PE value, as certified by a standards lab. The systematic validation of gamma-spec results yielded no significant qualifications to the data.

Laboratory Alpha Spectrometry

All alpha spec data were acceptable without qualification.

VOC (EPA 8260)

LCS and/or MS samples were either not run or not included within data packages for samples including RINs 98A2111 (22 samples; excavation boundaries), 98A2112 (4 samples; soil stockpile <5000cpm) and 98A2105 (DU) and could bias the associated results either high or low. As a result, the associated samples are qualified as estimates. However, for the data packages in question, the lab reports that MS samples are systematically run and evaluated for every 20 samples of throughput, which would constitute process control of accuracy, albeit in a less rigorous way than through batching.

Several blanks were contaminated with VOCs (especially with TCE), but these occurrences had no practical impact on sample results due to the significantly higher levels of like VOCs in the real samples. Stated differently, the potential for contamination to cause a high bias in real results was insignificant because of the relative, and significant, lower levels of VOCs in the QC samples. Blank contaminations did not impact project decisions (e.g., waste management, H&S, etc). Acetone was rejected in many samples due to low relative response factors (<0.05) in calibrations (initial and continuing).

SVOC (EPA 1311/3510/8270)

Accuracy of SVOCs are adequate, except for the qualifications listed below, based on the following analytical quality controls:

- ✓ initial calibration and continuing calibration of the measuring instrumentation
- ✓ performance checks (DFTPP),
- ✓ internal standard area/retention time checks,
- ✓ lab control samples (LCS),
- ✓ matrix spikes (MS), and
- ✓ blank results (method and TCLP).

Qualifications consist of rejecting all SVOC results for samples 98A2105-005 and -076 (2 DU samples) due to unacceptable surrogate recovery (<10%). All nondetect results were also rejected for samples 98A2105-005.004 and -076.004 due to gross exceedance of holding times (28 days).

PCBs (EPA 8081)

Due to a low surrogate recovery (between 10% and 30%) in sample 98A2111-037 (excavation boundary), the results are potentially biased low. In addition, only one surrogate was used for the batch 98A2111-A (4 samples), whereas 2 or more is commonly accepted as a minimum quality control. Many of the DU samples (RIN 98A2105) are potentially biased low due to exceedance of holdtimes, as well as samples 98A2116-011 and -009 (VOC-contaminated soil) and 98A2106-001 (lathe coolant).

Metals (TCLP, Total, and Mercury; EPA 1311/6010 & 7470)

With the exception of the qualified results discussed below, accuracy of metals results is adequate based on the following analytical quality controls:

- ✓ initial calibration and continuing calibration of the measuring instrumentation,
- ✓ interference check samples,
- ✓ serial dilutions,
- ✓ lab control samples (LCS),
- ✓ matrix spikes (MS), and
- ✓ blank results (preparation and TCLP).

Qualification of results includes a potentially low bias for the following (DU) samples and the associated metals of interest due to matrix spikes out of control or matrix interference:

Sample ID	Metal, potentially biased low
98A2105-179	Cr
98A2105-045, -063, -064	As
98A2105-051, -030, -024, -023, -021, -017	As, Se
98A2105-057, -070, -076, -083, -089, -095, -102, -108, -115, -121	As, Ag

Cyanide (EPA 9010)

All cyanide results were valid without qualification on accuracy.

Asbestos (EPA 40 CFR 763, Subpart F, Appendix A)

Accuracy for asbestos volumetric concentrations is based on the quantitative technique of petrography via polarized light microscopy. Experienced petrgraphers can typically quantify components to within several percent at high concentrations ranging to ~1% at low concentrations (essentially presence or absence of the mineral of interest). Accuracy for the project is adequate, as all samples with asbestos present had much greater than 1% asbestos by volume, the regulatory action level for asbestos.

7.3.3 Representativeness

All samples and surveys are representative, with exceptions noted below, based on the following criteria:

- ✓ familiarity with facilities -- multiple walk-throughs and collaborations by and within the sampling team;
- ✓ implementation of industry-standard Chain-of-Custody protocols;
- ✓ compliance with sample preservation and hold times;
- ✓ industry-standard and EPA-approved analytical methods (listed in Section 7.3.1)
- ✓ site-approved radiological survey methods; and,
- ✓ compliance with the SAPs (RMRS 1998c and Starmet, 1998) -- reviewed & approved by management consensus.

VOCs

All nondetect values are rejected due to gross exceedance of holdtimes for the following samples:

- 98A2105-185 through -196 plus -201 (depleted U)
- 98A2105-199, -205, -197, -198, -200, -202, -203, -207 (2 trip blanks included)
- 98A2105-132 through 140, -142, -143, -145 through 151, -155, -156 (3 trip blanks included)
- 98A2105-088, -096, -101, -103, -105, -106, -107, -109, -110, -116 (4 trip blanks included)
- 98A2105-152 through 154; and -157 through -165 (2 trip blanks)
- 98A2116-011, -012 (soil >25 ppm organic vapor)

Several samples from the excavation confirmation group were noted as being received at the lab with a temperature of ~20 degrees (C). Oridinarily this would be considered a sample preservation problem, however, these samples were transported from the sampling location to the lab in such a short timeframe that samples did not have time to fully chill. Therefore, sample preservation protocols were followed in this instance and false negatives due to inadequate preservation are not a possibility.

To summarize the VOC qualifications, the rejection of the samples listed above, as well as the associated low bias for samples with detections, does not impact project decisions relative to the waste streams due to the abundance of VOC detections that exceeded regulatory thresholds and consequent categorization as hazardous waste. Any false negatives that occur due to the biases discussed above have no bearing on the waste management and disposition.

SVOCs

All nondetect values are rejected due to gross exceedance of hold times for the following samples: 98A2105-153 through -167 (4 samples of depleted U).

PCBs

PCB results for the following DU samples are potentially biased low due to missed hold times

- 98A2105-021, -023, -029, -116, -119, -125, -126, -127, -148, -163 through -167, -169, -170, -171, -172, -173, -175, -176, -177, -178, 179, -181, -187, -190, -201
- 98A2116-011 and -009 (VOC-contaminated soils)

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All radiological surveys and analytical methods were performed to controlled, approved procedures.

7.3.4 Completeness

All T-1 data (~100%) were verified at the project level based on comparing planned samples (based on Chain-of-Custody records) with hardcopy data received from the laboratories. Verifications were performed in the field as work progressed on the trench, as sampling in the trench, as analytical results affected real-time remedial decisions.

The minimum requirement for data validation was specified as 25% for the project data set as a whole, and the project achieved this goal. In addition to the 25% validation requirement for the T-1 data set a whole, an effort was also made to orient the validations through a representative cross-section of each material category and analytical/radiological suite. In general, most categories were captured in the validation process, with the following exceptions; on-site gamma-spec on debris samples/lathe coolants and offsite analyses of cemented cyanides. Formal verification and validation packages are managed and archived with K-H Analytical Services Division in Building 881.

7.3.5 Comparability

All results presented are comparable with sampling and analyses (methods and media) on a national- and DOE-complex wide basis. This comparability is based on nationally recognized methods (especially EPA-approved methods), systematic quality controls, and thorough documentation of the planning, sampling, and analysis process.

7.3.6 Sensitivity

Sensitivity is evaluated by comparing actual quantitation limits of the results with the regulatory or project-specific action levels stipulated for decision-making. All analytical and radiological methods achieved adequate sensitivities in that quantitation limits were below regulatory thresholds, typically with a quantitation limit at less than 50% of the threshold.

7.3.7 Data Summary

In summary, the overall data sets acquired and evaluated for Trench-1 were satisfactory for supporting the (data quality) objectives for which they were acquired. The basic objectives, or decisions, consisted of:

1) whether several soil subpopulations are above or below regulatory (RFCA & PAM) thresholds, and
2) the types of waste streams generated and their acceptability under applicable WAC.

Qualifications to the data are discussed throughout this chapter; the stated qualifications did not impact final decisions or conclusions of the project because enough conservatism was designed into the SAP to compensate for limited amounts of estimated or rejected data. More specifically, many values were qualified as potentially biased low, or rejected as Nondetect values; especially VOCs. However, the potential for false negatives in the waste streams did not impact project decisions relative to waste handling because all waste streams with potential low bias also had associated results (i.e., of the same contaminant of interest) that were well above regulatory thresholds, and thus waste categorization was defined by the "hits" above thresholds and not the lack thereof.

Some qualifications were also made to sample results representing potential impacts to the trench boundaries or stockpiled soil to be used as backfill into the trench. The DQOs, which were more stringent for the excavation boundaries and potential backfill to the trench (vs. waste characterization), had no Rejected data like that of some waste streams. As a result, final confidence levels were consistent with original DQOs of the project.

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8.0 REFERENCES

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Appendix A
T-1 Restart Letters

Appendix A-1	Restart Letter Regarding Rapid Oxidation of DU (pyrophoric activity)
Appendix A-2	Restart Letters Regarding Encounter with Uranium Hydride Potentially Containing Tritium
Appendix A-3	Restart Letter Regarding Encountering Asbestos Within the Cemented Cyanide Matrix

Appendix A-1
Restart Letter Regarding
Rapid Oxidation of DU (pyrophoric activity)

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RMRS Rocky Mountain Remediation Services, L.L.C.
... protecting the environment

INTEROFFICE CORRESPONDENCE

DATE: June 11, 1998

TO: John E. Law, Director Environmental Restoration, T893B, x4842

FROM: Wayne Sproles, Environmental Restoration Projects, T893B, x5790 WWS

SUBJECT: Request for Approval to Restart Trench 1 Excavation Operations - WRS-030-98

The purpose of this correspondence is to provide a summary of the actions that will be taken during excavation to address elevated temperature measurements and request your approval to restart excavation activities at the Trench 1 site.

Activities were suspended on June 10, 1998 after temperature measurement and visual observations indicated a rapid oxidation of a non-intact drum of depleted uranium upon removal from the trench. In accordance with RFETS 1-D97-ADM-16.01, "Occurrence Reporting Process," the event was not a reportable occurrence. A manager's meeting was held on Wednesday, June 10 at 1530 hours in the T891C conference room to discuss issues involving the thermal reaction of excavated depleted uranium drums at the T-1 trench. Thirty-eight people attended the managers meeting (see Attachment A).

The managers meeting concluded that the following actions will be taken:

1) Modifications to Operations Order OO-T1-09, " Temperature Measurements Of Depleted Uranium Using Infrared Heat Gun," and the Trench 1 HASP to require continuous temperature monitoring of intact or non-intact drums until completion of inerting activities. Changes were also made to the response actions, including returning the intact or non-intact drums to the trench for inerting with soil when temperature measurements exceed action levels.

2) Changes in the excavation methodology, including removal of material from non-intact drum carcasses in the trench, mixing/inerting of depleted uranium material with soil in the trench if the temperature levels in 00-T1-09 are exceeded, excavating the mixed material, and placing the material in a B-12 container.

3) Changes will be discussed with the Trench 1 Team during the daily pre-evolution briefing prior to re-start of excavation activities.

4) Applicable documents have been reviewed to ensure that changes to Operations Order OO-T1-09, and the T1 HASP, do not impact the scope or requirements of these documents.

It should also be noted that the T-1 Project Team reacted in accordance with approved procedures in responding to the event. Radiological monitoring activities performed during and after the event (radiation surveys, contamination surveys, air monitoring) were below action levels. Based on contamination surveys there was no spread of contamination to personnel, equipment, or the area adjacent to the Trench.

The proposed actions have been implemented. Please indicate your approval for restart by signing below.

Approved: AE Primrose 6-11-98
for J. E. Law, Director Environmental Restoration

aw

Attachment:
As Stated

cc:
M. Burmeister, T893B
C. Crawford, B116
F. Hughes, T893A
C. Patnoe, T130C
D. Primrose, T893B
D. Swanson, T893B
R. Wagner, T893B
RMRS Records

TRENCH 1 SOURCE REMOVAL PROJECT
FACT FINDING MEETING ATTENDANCE ROSTER

DATE: 6/10/98 TRACKING NUMBER:______

NAME	ORGANIZATION	TELEPHONE/PAGER
S Walker-Lembke	KH CP&I	6350/212-1984
Jim Boyle	DOE	9742/1888 290 8775
Gary Noss	DOE-AMPA	4371/p 7827
Curt Hull	Stoller	4518/852-7306
Gary Kleeman	EPA	312-6246
Greg DiGregorio	RMRS QA	5688/212-6206
Dave Farley	RMRS E-1150Q	4340/d5248
Roy Tyler	DOE - AMEC	5927
Rick Wagner	RMRS - T1	2288/212-6363
~~Ken Gillespie~~	~~RMRS-T1~~	~~2787/3439/4007~~
Bill Prymak	DOE	5979/888-290-8735

TRENCH 1 SOURCE REMOVAL PROJECT
FACT FINDING MEETING ATTENDANCE ROSTER
DATE:__________TRACKING NUMBER:________

NAME	ORGANIZATION	TELEPHONE/PAGER
Norma Castaneda	DOE	4226 / 888-290-9018
Mark Brugh	SSOC - 559 Lab	7709 / 212-5759
Duane Parsons	DOE	6458
Bob Kautter	K-H	5756
Jill Bruse	KH	4807 / 212-3377
Annette Primrose	RMRS	4385 / 212-6338
TRACEY SPENCE	RMRS	4322 / 6152
DAVID BARNES	RTG/RMRS	5352 / 3542
KEVIN COPELAND	RMRS	4310 / 7074
Terry Overlid	RMRS	4407 / 4231

TRENCH 1 SOURCE REMOVAL PROJECT
FACT FINDING MEETING ATTENDANCE ROSTER
DATE: 6/10/98 TRACKING NUMBER:______

NAME	ORGANIZATION	TELEPHONE/PAGER
MARK BURMEISTER	RMRS-ER	x5891 / 212-6228
Susan Myrick	RMR-ER	x5051 / 4343
Doyle Gillespie 3:50 4:35	WH Qual Psyc	x2413 / 3159
BATES ESTABROOKS	RMRS – RAD ENG.	X 3769 / 3209
JEFF BARROSO	RMRS - RE	x8451 / D5888
Wayne Sproles	RMRS - ER	x 5790 / 212-5651

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TRENCH 1 SOURCE REMOVAL PROJECT
FACT FINDING MEETING ATTENDANCE ROSTER

DATE:__________ TRACKING NUMBER:__________

NAME	ORGANIZATION	TELEPHONE/PAGER
Clarence Buchholz	JCUSC / USWA	X5801 / 259-4157
Ted Tegeler	JCUSC / USWA	5800 / 212-3432
Jeff Herring	KH	2505 / 0993
Lane Butler	KH	5245 / 212-3017
Kevin Daniels	K-H	X5844 / 212-1979
Steve Crowe	K-H CPI	7548 / 212-1971
Michael Bemski	RMRS / T-1	4090 / 212-6271
Jerry Stakebake	DOE	2507
Tom Greengard	KH	5635 / 212 / 1968
Hopi Salomon	MK	6627 / 212-6244
Anne White	RTG / RMRS	5180

Appendix A-2
Restart Letters Regarding
Encounter with Uranium Hydride Potentially Containing Tritium

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RMRS Rocky Mountain Remediation Services, L.L.C.
. . . protecting the environment

INTEROFFICE MEMORANDUM

DATE: August 6, 1998

TO: John Law, Environmental Restoration Projects, T893B, x4842

FROM: Wayne Sproles, Environmental Restoration Projects, T893B, x5790 WR

SUBJECT: LIMITED RESTART OF TRENCH 1 EXCAVATION ACTIVITIES – WRS-048-98

The purpose of this correspondence is to request approval for a limited restart of the Trench 1 Project. Per the managers meeting held on August 6, 1998, in T900F, the path forward is to conduct an entry into the tent to collect approximately 10 tritium swipe samples, two water samples from a bucket of water that is adjacent to the trench, one soil sample from the 55-gallon drum, and one soil sample from the B-12. The soil samples will be collected from the waste containers that contain the depleted uranium material from Lawrence Livermore. Five of the tritium swipe samples will be analyzed by ThermoNutech and it is anticipated that the remaining samples will be analyzed at EPI Laboratories in South Carolina. The shipment of samples to EPI will be based on the results of DOT shipping screens that will be performed by ThermoNutech. If the level of radioactivity in the soil samples exceeds the EPI's radioactive material license, another approved laboratory will be selected.

A new Activity Hazard Analysis has been prepared to address the hazards associated with this evolution. The staytime within the tent will be based on WBGT reading inside the tent structure. WBGT readings and staytimes will be closely monitored by Health and Safety. PPE for this evolution has been evaluated and will remain unchanged from PPE that is used for excavation activities.

The following schedule of events for this evolution is based on the collection of samples on August 6, 1998:

August 6, 1998 Collect samples from the tent interior. Swipe samples and DOT shipping screens will be shipped to ThermoNutech for analysis.

August 7, 1998 Sample analysis at ThermoNutech will be completed and evaluated by the project SMEs. Sample analysis will take approximately 12 hours from the time the samples are submitted to ThermoNutech. Samples will be shipped to EPI based on the results of DOT shipping screens analyzed by ThermoNutech. If the analysis indicates no

If the sample results are not conclusive, then the project will remain on hold awaiting analytical results from EPI.

August 11, 1998 Completion of analysis at EPI. The analysis of samples at EPI will be completed three days from receipt at the EPI Laboratory.

August 27, 1998 Completion of bioassay analysis. The analysis of samples at EPI will be completed fourteen days from receipt at the EPI Laboratory.

The project staff is working closely with the Analytical Program Office to expedite sample analysis at the offsite laboratories.

A separate request for restart of excavation activities will be submitted for approval after receipt and evaluation on the analytical results. In addition, a separate letter has been approved by Radiological Safety to perform this evolution.

APPROVAL:

John E. Law 8/6/98

John E. Law, P.E. Date
Director
Environmental Restoration Projects

laa

cc:
M. C. Burmeister
F. P. Hughes
R. A. Wagner
RMRS Records

RMRS Rocky Mountain Remediation Services, L.L.C.
... protecting the environment

INTEROFFICE MEMORANDUM

DATE: August 6, 1998

TO: John Law, Environmental Restoration Projects, T893B, x4842

FROM: Wayne Sproles, Environmental Restoration Projects, T893B, x5790

SUBJECT: LIMITED RESTART OF TRENCH 1 EXCAVATION ACTIVITIES – WRS-048A-98

The purpose of this correspondence is to request approval for a limited restart of the Trench 1 Project. Per the managers meeting held on August 6, 1998, in T900F, the path forward is to conduct an entry into the tent to collect approximately 10 tritium swipe samples, two water samples from a bucket of water that is adjacent to the trench, one soil sample from the 55-gallon drum, and one soil sample from the B-12. The soil samples will be collected from the waste containers that contain the depleted uranium material from Lawrence Livermore. Five of the tritium swipe samples will be analyzed by ThermoNutech and it is anticipated that the remaining samples will be analyzed at EPI Laboratories in South Carolina. The shipment of samples to EPI will be based on the results of DOT shipping screens that will be performed by ThermoNutech. If the level of radioactivity in the soil samples exceeds the EPI's radioactive material license, another approved laboratory will be selected.

A new Activity Hazard Analysis has been prepared to address the hazards associated with this evolution. The staytime within the tent will be based on WBGT reading inside the tent structure. WBGT readings and staytimes will be closely monitored by Health and Safety. PPE for this evolution has been evaluated and will remain unchanged from PPE that is used for excavation activities.

The following schedule of events for this evolution is based on the collection of samples on August 6, 1998:

August 6, 1998 Collect samples from the tent interior. Swipe samples and DOT shipping screens will be shipped to ThermoNutech for analysis.

August 7, 1998 Sample analysis at ThermoNutech will be completed and evaluated by the project SMEs. Sample analysis will take approximately 12 hours from the time the samples are submitted to ThermoNutech. Samples will be shipped to EPI based on the results of DOT shipping screens analyzed by ThermoNutech. If the analysis indicates no

,2

If the sample results are not conclusive, then the project will remain on hold awaiting analytical results from EPI.

August 11, 1998 Completion of analysis at EPI. The analysis of samples at EPI will be completed three days from receipt at the EPI Laboratory.

August 27, 1998 Completion of bioassay analysis. The analysis of samples at EPI will be completed fourteen days from receipt at the EPI Laboratory.

The project staff is working closely with the Analytical Program Office to expedite sample analysis at the offsite laboratories.

A separate request for restart of excavation activities will be submitted for approval after receipt and evaluation on the analytical results. In addition, a separate letter has been approved by Radiological Safety to perform this evolution.

APPROVAL:

John E. Law, P.E. Date
Director
Environmental Restoration Projects

laa

cc:
M. C. Burmeister
F. P. Hughes
R. A. Wagner
RMRS Records

RMRS Rocky Mountain Remediation Services, L.L.C.
. . . protecting the environment

DATE: August 10, 1998

TO: John E. Law, Environmental Restoration Projects, T893B, x4842

FROM: Wayne R. Sproles, Environmental Restoration Projects, T893B, x5790

SUBJECT: LIMITED RESTART OF TRENCH 1 EXCAVATION ACTIVITIES - WRS-049-98

The purpose of this correspondence is to request approval to restart the Trench 1 Source Removal Project, with the exception of sampling wastes containing uranium hydride.

It was decided at the Managers Meeting held on August 7, 1998 with RMRS, Kaiser-Hill and DOE, that the following actions will be completed prior to restart:

- Review of the swipe sample results from the offsite laboratory to further confirm that tritium was not encountered, and

- Re-evaluation of the hazards and controls associated with excavation, packaging and sampling activities.

It was also decided at the meeting that restart authority for excavation activities will reside with RMRS Director of Environmental Projects and the SSOC Division Manager of Radiological Safety.

Analytical results from swipe samples collected inside the tent structure and a water sample collected from a bucket of water adjacent to the trench indicate tritium was not present above the instrument MDA. In addition, an air sample, collected from a sealed drum containing the suspect material was analyzed by Thermo-Nu-Tech and indicated that tritium was not present above background levels.

On August 10, 1998, the Trench 1 Project Team re-evaluated the work process, hazards, and controls associated with the excavation activities. It was determined that existing project implementation documents satisfactorily address the hazards associated with excavation activities and the controls already in place are appropriate for handling uranium hydride. Although the process will remain unchanged, the project team will be instructed to better communicate changing conditions, and to limit the number of personnel around the excavator bucket to only those that are essential during monitoring activities.

On August 10, 1998, a meeting was held with Building 559 personnel to discuss transfer, preparation, and analysis of uranium hydride samples as well as the potential fire hazards associated with these activities. Building 559 personnel are currently evaluating their authorization basis, existing procedures, and fire protection measures.

The Trench 1 Project Team is evaluating the process for sampling uranium hydride wastes, packaging and transferring samples to Canberra for gamma spectroscopy analysis, and subsequently transfering samples to Building 559 for VOC, PCB and isotopic analyses.

Based on historical documentation, we believe that all of the uranium hydride wastes have been excavated from the trench. However, in the event that additional uranium hydride is encountered, the material will be placed in a waste container, inerted, and temporarily staged until restart has been approved for sampling uranium hydride.

A separate letter has been approved by the SSOC Division Manager of Radiological Safety to resume excavation activities with no additional radiological controls beyond those already being implemented.

John E. Law

John E. Law, P.E.
Director
Environmental Restoration

wrs

cc:
RMRS Records
M. Burmeister
F. Hughes
R. Wagner

RMRS Rocky Mountain
Remediation Services, L.L.C.
. . . protecting the environment

Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, Colorado 80402-0464
Phone: (303) 966-7000

August 10, 1998

Don Harward
Divison Manager, Radiological Safety
Safe Sites of Colorado, L.L.C
Building T130C

RECOMMENCE NORMAL EXCAVATION ACTIVITIES ON THE TRENCH-1 PROJECT – JEL-0143-98

The Trench -1 (T-1) Project is requesting your concurrence, by signature below, to recommence normal excavation activities on the Trench-1 project. The suspected presence of tritium, based on a concern expressed by SSOC Radiological Engineering, has been investigated through the collection and analysis of smear samples and one sample of water in a bucket located near the trench.

The results of these analyses, using distillation and liquid scintillation counting performed by Environmental Physics Inc., indicates no tritium present above background levels. In addition, an air sample, collected from of a sealed container containing the suspect material, was analyzed by Thermo-Nu-Tech and indicated no tritium above background levels.

As a result, on the basis of the speculative nature of the tritium concern in the first place, and on this confirmation of the absence of tritium, the Trench-1 project will proceed with no additional radiological controls beyond those already implemented. This course of action has been presented to the entire T-1 project team, and has been accepted by them.

John E. Law

John Law
Director
Environmental Restoration Projects

Approval Signature

Don Harward

Don Harward | 8/10/98
Date

RMRS Rocky Mountain Remediation Services, L.L.C.
. . . protecting the environment

INTEROFFICE MEMORANDUM

DATE: August 11, 1998

TO: John Law, Environmental Restoration Projects, T893B, x4842

FROM: Wayne Sproles, Environmental Restoration Projects, T893B, x5790

SUBJECT: RESTART OF TRENCH 1 SAMPLING ACTIVITIES - WRS-051-98

The purpose of this correspondence is to request approval to restart Trench 1 Project sampling activities. Sampling of uranium hydride was suspended when three metal cans containing ~250-ml glass jars suspected of containing uranium hydride (one of the jars was marked "UH_3") were excavated on 8/5/98. Excavation activities were restarted on 8/11/98 (Reference WRS-049-98, 8/10/98). Sampling of uranium hydride was not restarted at this time to ensure that the controls are in place to sample this potentially hazardous material.

Based on a meeting between Trench 1, Building 559, and fire protection personnel held on 8/10/98, and subsequent discussions among Trench 1 Project personnel involved in the sampling process, the following "path forward" is proposed:

1. Review project documentation to determine if existing plans and procedures adequately cover the sampling of uranium hydride (Action completed 8/11/98 - no changes necessary).

2. Sample the 55-gallon drum and B-12 waste crate containing the uranium hydride wastes. Personnel will use long-handled tools to collect the samples. Inerting materials will be readily available in the event of a pyrophoric reaction. This sampling activity is adequately covered by existing activity hazard analyses and the Starmet Sampling and Analysis Plan.

3. Perform gamma spectroscopy analysis on the samples obtained from the 55-gallon drum and B-12 waste crate. Following gamma spectroscopy analysis, these samples will be transferred to the Building 559 lab for analysis.

4. Quantify the number, approximate weight and volume of intact jars excavated on 8/5/98. These jars are currently contained in a 55-gallon drum, a 1-gallon paint can, and a B-12 waste crate staged inside the tent near the

Sampling and Inerting Pad. A task specific pre-evolution brief will be conducted prior to performing this activity.

5. Transfer the contents of the 55-gallon drum and the 1-gallon paint can into the B-12 waste crate to consolidate the uranium hydride wastes.

6. Coordinate with Fire Protection Engineering and Building 559 personnel to develop a plan for the safe packaging and transport of the intact jars from the tent to the gamma spectroscopy lab (i.e., T-900C) and subsequently to the lab in Building 559. These containers will be opened in a controlled manner in the Building 559 laboratory. If necessary, Operations Orders OO-T1-04, "On-site Transfer of Potentially Pyrophoric Samples From The Trench T-1 Source Removal Project," and/or OO-T1-07, "Packaging of Trench 1 (T-1) Waste," will be revised to address packaging and transport of the intact jars.

Building 559 personnel are currently assessing the adequacy of their authorization basis and procedural coverage with respect to the receipt and opening of the intact jars in their laboratory. Transfer of intact jars to Building 559 will not be performed until their assessment is complete.

APPROVED:

John E. Law   8/11/98

John E. Law, P.E.   Date
Director
Environmental Restoration Projects

laa

cc:
M. C. Burmeister
F. P. Hughes
R. A. Wagner
RMRS Records

RMRS Rocky Mountain Remediation Services, L.L.C.
... protecting the environment

INTEROFFICE CORRESPONDENCE

DATE: September 1, 1998

TO: John E. Law, Environmental Restoration Projects, T893B, x4842

FROM: Wayne Sproles, Environmental Restoration Projects, T893B, x5790

SUBJECT: MODIFICATION TO LETTER WRS-051-98, RESTART OF TRENCH 1 SAMPLING ACTIVITIES - WRS-061-98

The purpose of the correspondence is to obtain approval for the sampling approach for uranium hydride (UH_3) contained within two 55-gallon drums and one B-12 container inside the Trench 1 tent. Sampling activities associated with potential uranium hydride have been suspended since excavation of three metal cans containing ~250ml glass jars of material (one marked "UH_3") on 8/5/98. This correspondence supersedes previous correspondence on this evolution (WRS-051-98).

A meeting was held on August 31, 1998 with T-1 workers, Fire Protection Engineering, Radiological Engineering, RMRS Project Management, Kaiser-Hill Project Management, Kaiser-Hill Closure Projects Engineering and Integration, RMRS Health and Safety, Kaiser-Hill Air Quality Management, and RMRS Authorization Basis to review the sampling approach, the associated hazards, and the controls that will be implemented for worker safety.

On August 31, 1998, Air Quality Management completed a fire scenario model for this activity and determined that the potential impact associated with this evolution is within the bounding conditions established in the original model for the project.

On August 31, 1998, RMRS Authorization Basis agreed that the sampling evolution was within the existing authorization basis for Trench 1.

On September 1, 1998, Fire Protection Engineering completed a review of the Fire Hazard Analysis, and determined that the controls in the original FHA are adequate for this activity.

On September 1, 1998, a new Activity Hazard Analysis, specific to this sampling evolution, was approved. In addition, Trench 1 documents, plans and procedures were reviewed and determined to adequately cover sampling of uranium hydride material.

Building 559 Laboratory personnel have agreed to analyze the samples provided that the sample containers are 20 mL containers. Changes to laboratory procedures will not be required for 20 mL sample containers.

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The proposed sampling approach is described as follows:

1. The 55-gallon drums and B-12 box that contain the uranium hydride will be opened and the contents will be examined to determine if additional intact sample containers exist. Personnel will use long-handled tools where appropriate to search for the sample containers, retrieve the sample containers, and collect samples from the intact sample containers.

2. Some direct handling of the sample containers will be required. Personnel handling the sample containers will be protected by fire and puncture resistant gloves.

3. Monitoring for tritium will occur during the evolution.

4. Inerting materials and fire extinguishing equipment will be readily available in the event a reaction is experienced and a full-time personnel/area fire watch will be posted.

5. Small fires, similar to those experienced previously, are anticipated and will not require a stop work unless the bounds set forth in the HSP and RWP are exceeded.

6. Personnel in the tent will be minimized during the evolution.

7. Samples from the intact sample containers will be transferred to the T900C Gamma Spectroscopy Laboratory and the Building 559 Laboratory for analysis.

8. At the completion of the sampling activity, the contents of the 55 gallon drum and B-12 box will be consolidated into the B-12 box.

9. Transportation of sample materials will be in accordance with approved Operations Order OO-T1-04 On-site Transfer of Potentially Pyrophoric Samples from the Trench-1 Source Removal Project.

10. The sampling approach, hazards associated with this sampling evolution, and the controls to be implemented for worker safety have been reviewed with the project team during the pre-evolution briefing on September 1, 1998. Worker input has been incorporated into the sampling methodology and hazard controls for the project.

Approved:

John E. Law

John E. Law, P.E.
Director
Environmental Restoration Projects

wrs

cc:
M. Burmeister
F. Hughes
R. Wagner
RMRS Records

Appendix A-3
Restart Letter Regarding
Encountering Asbestos Within the Cemented Cyanide Matrix

RMRS Rocky Mountain Remediation Services, L.L.C
. . . protecting the environment

DATE: August 13, 1998

TO: John Law, Environmental Restoration Projects, T893B, x4842

FROM: Wayne Sproles, Environmental Restoration Projects, T893B, x5790

SUBJECT: Restart of Trench 1 Excavation Activities - WRS-053-98

The purpose of this memorandum is to request approval for restart of Trench 1 excavation activities. Per the T-1 HASP, Section 7.7, excavation activities were suspended on August 12, 1998 due to suspected asbestos in the cemented cyanide waste drums by visual observation. Analysis of the cemented cyanide samples on August 12, 1998, confirmed an asbestos concentration of approximately 15-25%.

The following actions will be performed prior to restart to ensure work can proceed safely with minimal risk to workers:

1. Asbestos Awareness Training has been completed for required project personnel. (Complete 8/13/98)

2. On August 13, 1998 surface "tape" samples and continuous air monitor filter samples were collected from both vestibules and analyzed for asbestos. The samples were transferred to Building 881 for asbestos analysis by Polarized Light Microscopy. Sample results indicate that no asbestos fibers exist on the sample media and, therefore, there is no evidence of asbestos dispersion.

3. Changes have been implemented to the T-1 HASP. These changes include: a new Activity Hazard Analysis to address asbestos hazards and work controls to ensure worker safety and additional training requirements for personnel likely to contact asbestos containing material.

4. All material in contact with potentially asbestos containing wastes will be handled in accordance with the asbestos regulations.

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5. We have consulted with RMRS Health and Safety, as well as Linda Guinn, RMRS Corporate Counsel, and have verified that project personnel training and project procedures meet the requirements of 29CFR1926.1101.
6. Changes to the HSP, waste management practices, analytical results and necessary work revisions will be reviewed with the project team prior to commencing work.

Approved

John E. Law

John E. Law, P.E.
Director
Environmental Restoration Projects

wrs

cc:
RMRS Records
M. Burmeister
F. Hughes
R. Wagner

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Appendix B
Results of Air Monitoring Program at T-1

TRENCH 1 AMBIENT AIR MONITORING RESULTS

Background

An enhanced, project-specific ambient air monitoring program was implemented during excavation, segregation, sampling, and inerting of depleted uranium chips and associated soils and wastes at T-1, IHSS 108. The ambient air monitoring was performed to ensure that the potential radionuclide emissions from the T-1 source removal project did not exceed the Site 10 millirem (mrem) per year public dose standard specified in Title 40 of the Code of Federal Regulations (CFR), Part 61, Subpart H, Section 61.92.

In relation to the 10 mrem standard in 40 CFR 61, Subpart H and Department of Energy (DOE) Order 5400.1, the Site maintains an ambient air monitoring program that provides information on a monthly basis about radionuclide concentrations in the air at various locations along the Site perimeter. Additional samplers on-site and community are operated to detect and quantify air concentrations should there be a suspected release.

Enhanced Air Monitoring Program

The project-specific ambient air monitoring for T-1 consisted of enhanced routine monitoring in the immediate vicinity of the T-1 project using the existing Radioactive Ambient Air Monitoring Program (RAAMP) network at the Site. The existing RAAMP sampling network is shown in Figure 1 relative to the T-1 site. Filters from Samplers S-106, S-107, S-119, and S-121 were changed weekly, screened for gross alpha/beta contamination, and submitted for isotopic analyses. The alpha/beta screening results from the four project-specific RAAMP samplers were compared on a weekly basis to a project-specific threshold and a regulatory-based threshold. The project-specific threshold served to compare the radionuclide emission level during the previous week to the level that would approximate a 1 mrem dose at the Site perimeter if the emissions were to continue at that level for the duration of the T-1 project. The regulatory-based threshold corresponded to a radionuclide emission level during the previous week that would approximate a 5 mrem dose at the Site perimeter if the emissions were to continue at that level for the duration of the project.

To characterize the radionuclide emissions generated by activities conducted inside the temporary structure, three high-volume particulate air samplers were located near the activities with the greatest potential to release radionuclides into the atmosphere. Figure 2 provides a schematic layout of the temporary structure and shows the locations of the three samplers relative to the project activities. Sampler T1-B was located near the trench excavation and was moved as excavation advanced along the trench. Sampler T1-A was located on the sampling and inerting pad (SIP), where depleted uranium chips/turnings and other associated material removed from the trench were inerted and packaged in overpack containers. Sampler T1-C was located near the soil stockpile area where excavated soils were staged.

Samplers T1-A, T1-B, and T1-C operated continuously (24 hours per day, 7 days per week) throughout the trench excavation and material handling activities. The filters from the three air samplers were collected and exchanged approximately two times each week and screened for gross alpha/beta contamination. The filters were composited on a monthly basis for radioisotopic analysis.

An immediate exchange of filters on the samplers inside the structure was required on several occasions due to incidents that had a potential for an unexpected and uncharacterized release of radionuclides during the excavation activities. These filters were screened for gross alpha/beta contamination and submitted for expedited isotopic analysis.

Air Monitoring Results

Prior to beginning excavation, background levels of radioactive ambient air concentrations were collected over a four-week period from RAAMP Samplers S-106, S107, S-119, and S-121 and a two-week period for Samplers T1-A, T1-B, and T1-C. Average background levels and average +/- 2 standard deviations were estimated based on the variability of data collected during these sampling periods.

The time-series chart in Figure 3 for RAAMP Samplers S-106, S-107, S-119, and S-121 shows the radioactive air concentration in picocuries per cubic meter (pCi/m^3) from the alpha screens to be slightly above background during the T-1 project, but approximately one order of magnitude below the 1 mrem dose to the public threshold.

The graphs in Figures 4, 5, 6, and 7 for Samplers S-106, S-107, S-119, and S-121 show air monitoring isotopic data outside the tent for the entire project period. Plutonium (Pu), americium (Am) and uranium concentrations were observed at typical ambient levels throughout the project.

The time-series charts for Samplers T1-A and T1-B in Figure 8 show the weekly radioactive air concentrations in pCi/m^3 from alpha screens remained consistently about one order of magnitude above background, but three to four orders of magnitude below the 1 mrem project threshold concentration during the project. The project threshold concentration was estimated based on emissions modeled using CAP88-PC air dispersion model and the number of drums of depleted uranium removed from the trench each week. The line chart for Sampler T1-C in Figure 8 shows that the weekly radioactive air concentration as determined from alpha screens consistently remained near background during the project.

The samples collected inside the tent were analyzed for isotopic content for the entire project period. The graphs in Figures 9, 10 and 11 for Samplers T1-A, T1-B, and T1-C indicate increased concentrations of depleted uranium in the air inside the tent during the project. The highest concentrations of depleted uranium in the ambient air inside the tent were observed during the excavation and SIP activities. The relative differences in concentrations of U-238 between Samplers T1-A and T1-C vary by a factor of 100, which indicates that the SIP and excavation activities generated the highest concentrations of depleted uranium to the air inside the tent. These data also suggest that the majority of the airborne particles did not mix well or carry far in that environment. Plutonium and Am concentrations were observed at normal ambient levels inside the tent throughout the project.

Uranium Hydride (UH_3) Fire

The air filter from Sampler T1-B was changed on 5 August 1998, because of a possible release of UH_3 that occurred from a small fire during excavation activities. The filter from Sampler T1-B was screened for gross alpha/beta contamination at an on-Site laboratory and submitted to an off-Site laboratory for immediate isotopic analysis for Pu, Am, and tritium (H-3).

The radioactive air concentrations from the alpha screens in the time-series chart in Figure 8 show an elevated activity for sampling period 8/4 to 8/11 for Sampler T1-B. Even though the possible release of UH_3 generated an increase in radioactive air concentrations inside the temporary structure, the elevated concentration was still approximately three orders of magnitude below the modeled project threshold concentration.

Comparing the isotopic analysis in Figure 12 for Sampler T1-B indicates a ratio of U-234 to U-238 is approximately one, which indicates natural uranium was observed near the trench during the fire, in contrast, (depleted uranium would show a ratio well below one). The isotopic results for Pu, Am-241, and U-235 showed negligible levels for sampling period 8/4 to 8/5.

The H-3 results in Figure 13 show the measured concentration from Sampler T1-B to be approximately two orders of magnitude less than the possible H-3 contribution from cosmogenic airborne radioactivity. "The decay and settling of cosmogenic concentrations of some isotopes in the environment may vary considerably in large part with altitude, and can vary as much as two orders of magnitude. The shorter lived cosmogenic radionuclides usually decay before settling to the earth and entering the ecosphere" (Kathern, 32-33). Even if the cosmogenic concentrations of H-3 in the air could potentially be two orders of magnitude less at ground level, the H-3 concentration measured at the trench from the UH_3 fire is still insignificant. The background information of cosmogenic radionuclides is published in *Radioactivity in the Environment Sources Distribution, and Surveillance,* by Ronald L. Kathren, copyright 1984.

Soil Backfilling

Backfilling of T-1 was performed using the soil originally excavated from the trench and soil from Investigation Derived Material (IDM) drums. To characterize the radionuclide emissions generated by soil backfilling activities conducted inside the temporary structure, one high-volume particulate air sampler was located near the trench. Sampler T1-B was located near the trench and was moved as backfilling advanced along the trench.

The bar chart for Sampler T1-B in Figure 14 shows the radioactive air concentrations in pCi/m^3 from alpha screens remained consistently about one order of magnitude above background, but five orders of magnitude below the 1 mrem project threshold concentration (average modeled concentration) during the project. The average modeled concentration was estimated based on emissions modeled using CAP88-PC air dispersion model and the number of drums of depleted uranium removed from the trench each week. The bar chart for Sampler T1-B in Figure 14 shows that the radioactive air concentration as determined from alpha screens consistently remained just above background during backfilling.

Air Monitoring Conclusion

The data represented in the two graphs in Figure 15 for the two samplers showing the highest concentrations during the study, Sampler T1-B inside the tent and Sampler S-121 outside, show dramatic differences in relative concentrations of U-234 and U-238. Results of the ambient air measurements inside and outside the T-1 tent structure differ by several orders of magnitude. This behavior suggests that the tent was very effective in attenuating air emissions from the project. Note the relative differences in concentrations of U-234 and U-238, indicating minimal contributions from project-generated depleted uranium to the air concentrations outside the tent.

References

Kathern, Ronald L. *Radioactivity in the Environment Sources Distribution, and Surveillance.* Harwood Academic Publishers, New York, NY. 1984, pp. 32-33.

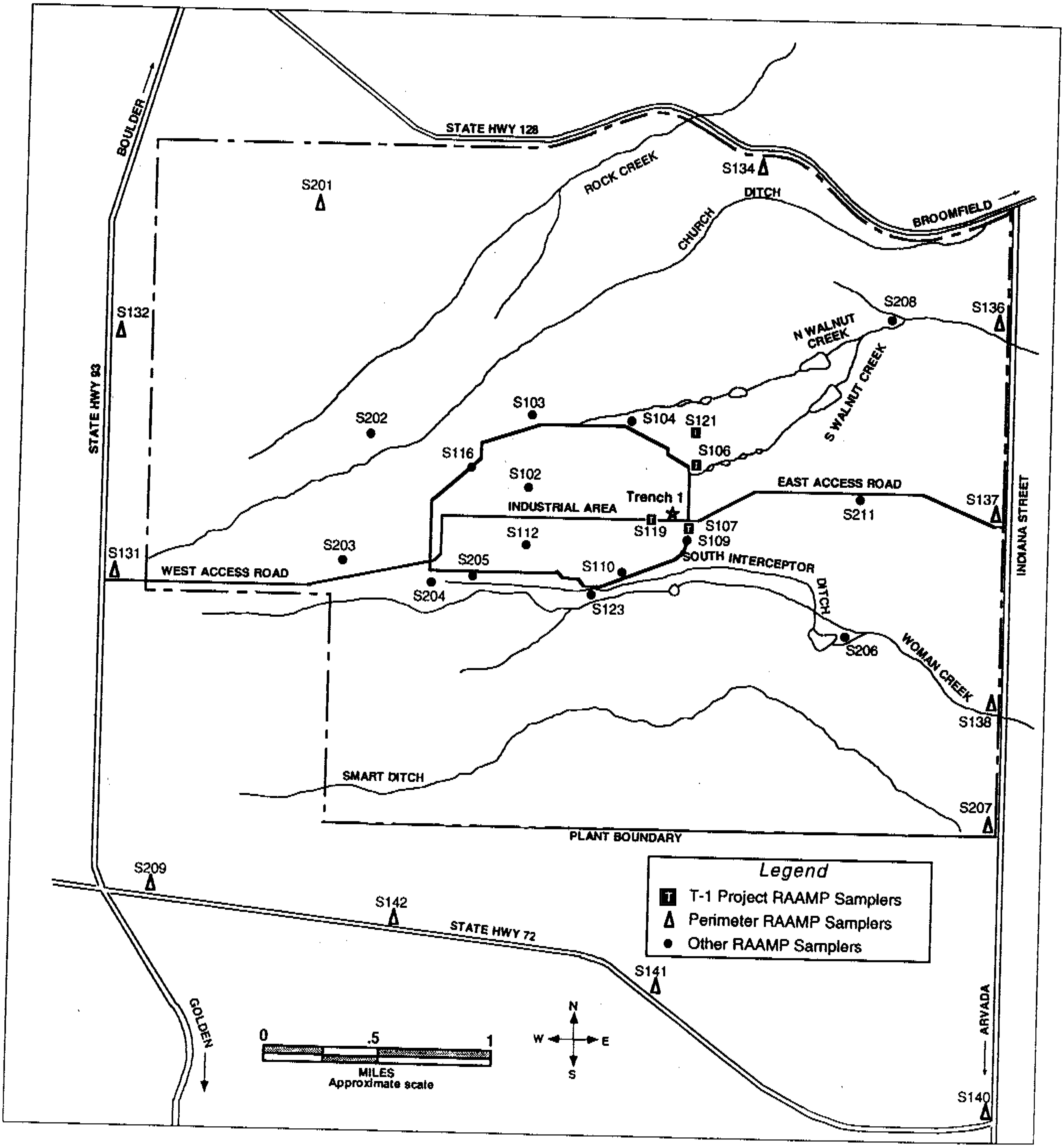

Figure 1. RAAMP Sampler Location Map

8

RAAMP Samplers Located Around T-1 Site
(Alpha Screens)

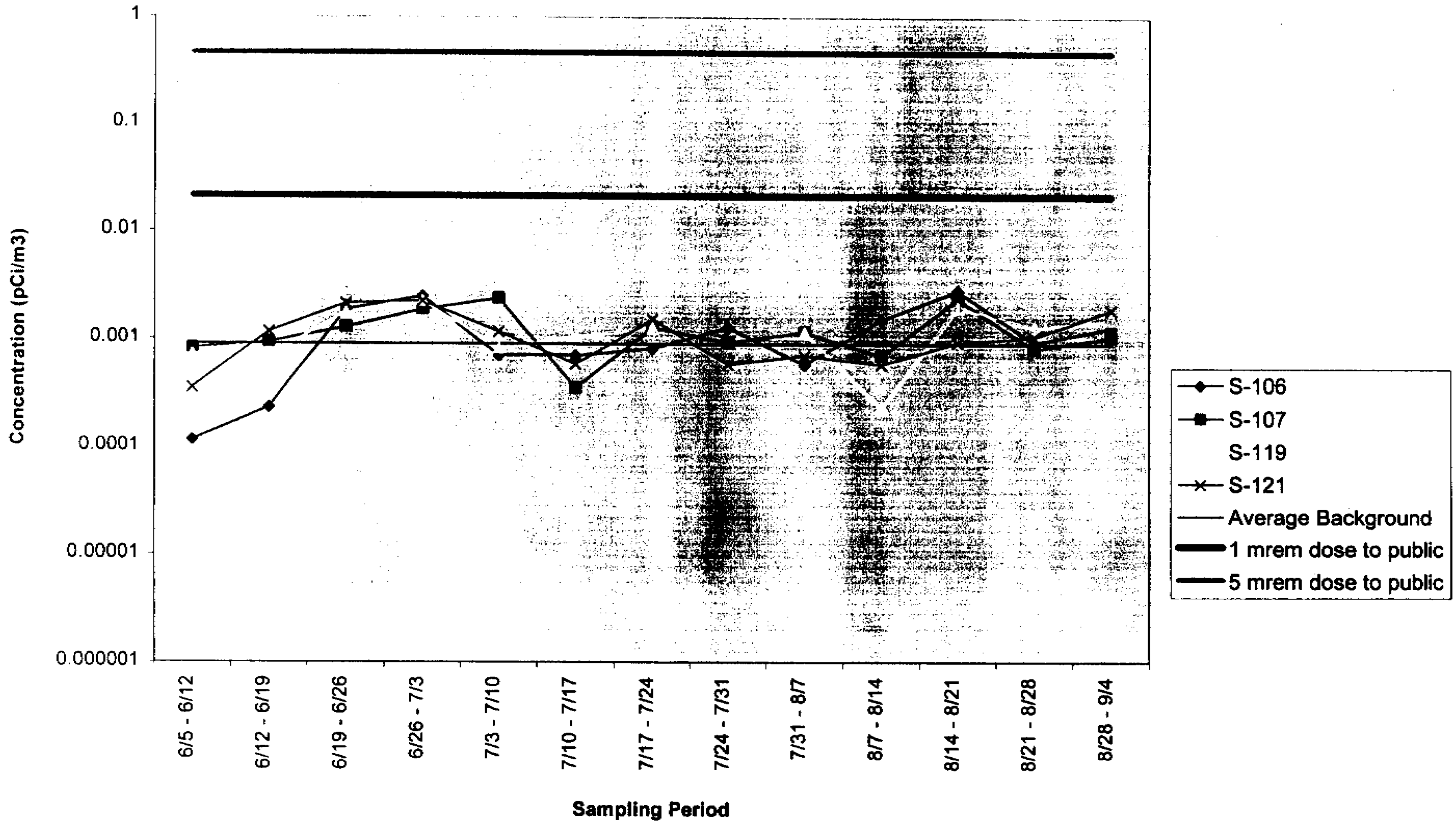

Figure 3

80

Isotopic Results
Sampler S-106

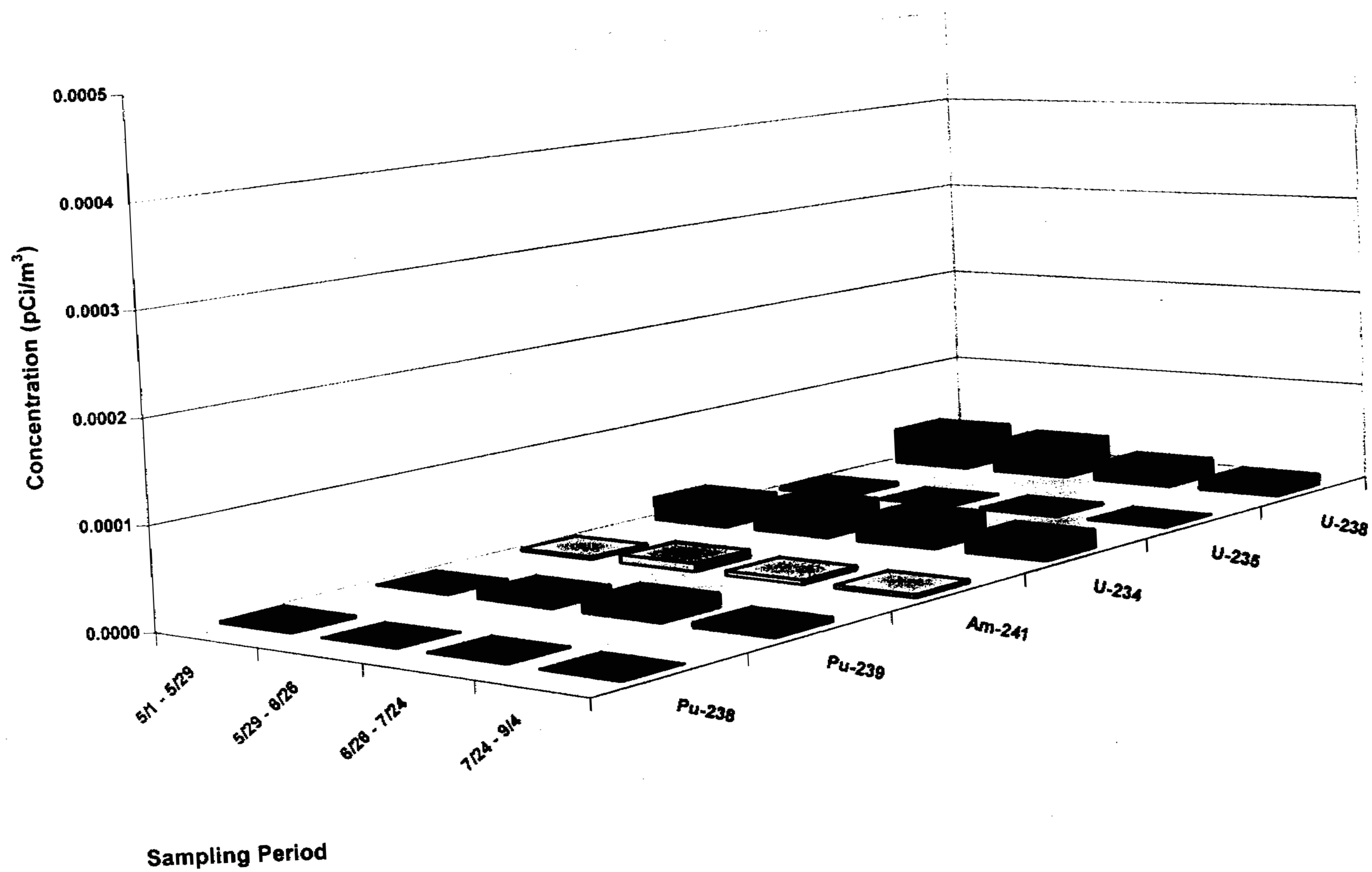

Figure 4

Isotopic Results
Sampler S-107 (East of 903 Pad)

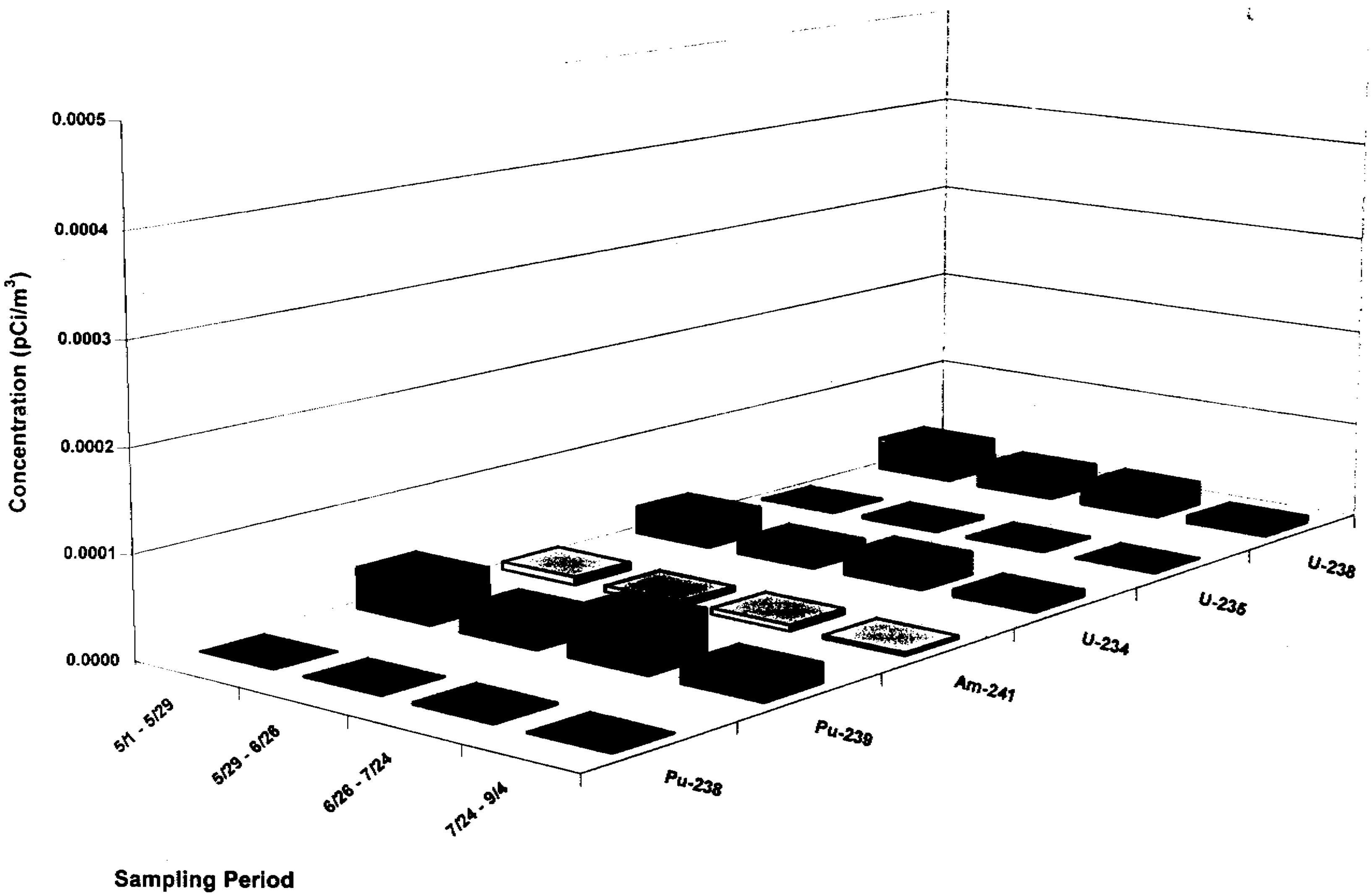

Figure 5

2

Isotopic Results
Sampler S-119

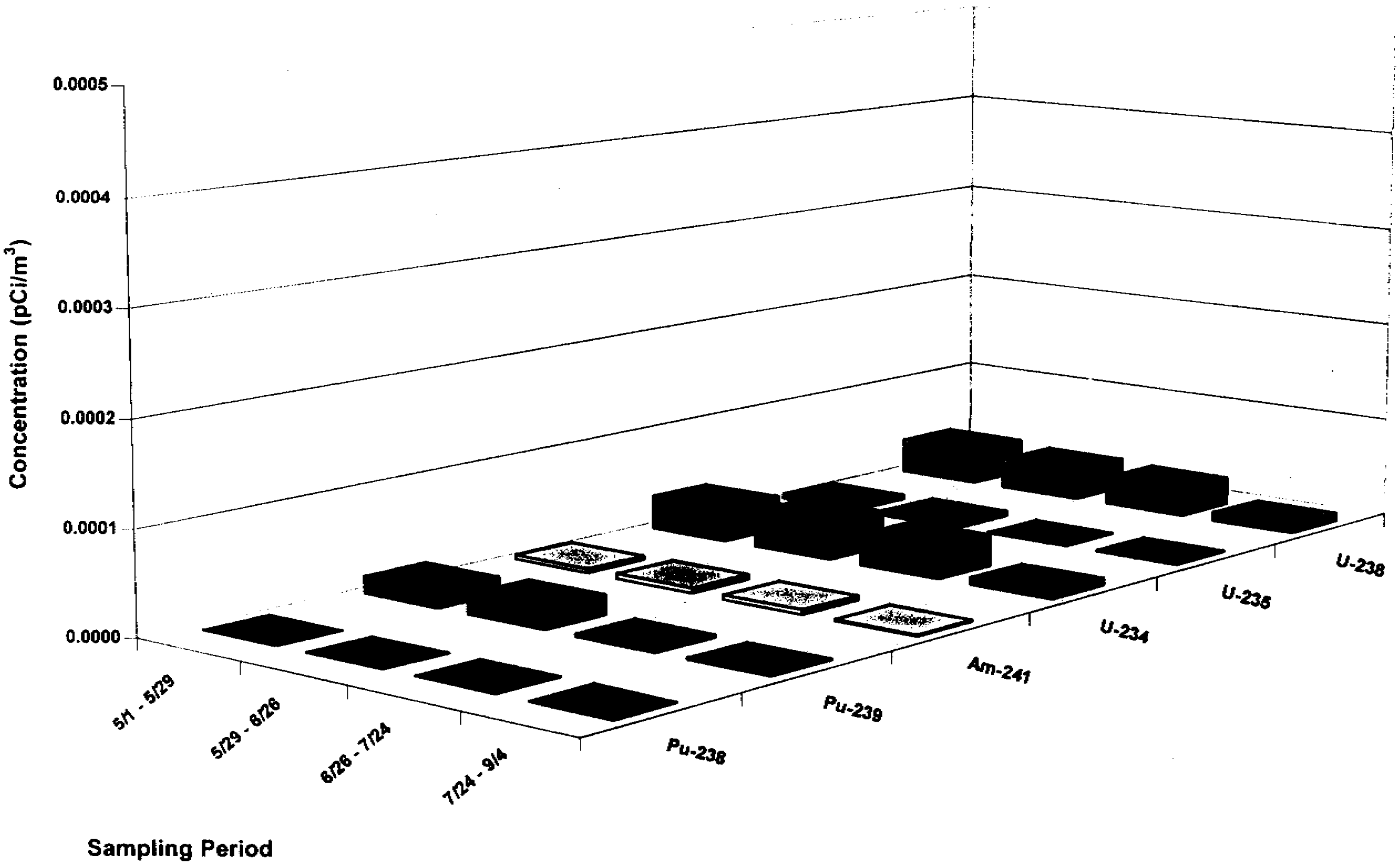

Figure 6

23

Isotopic Results
Sampler S-121

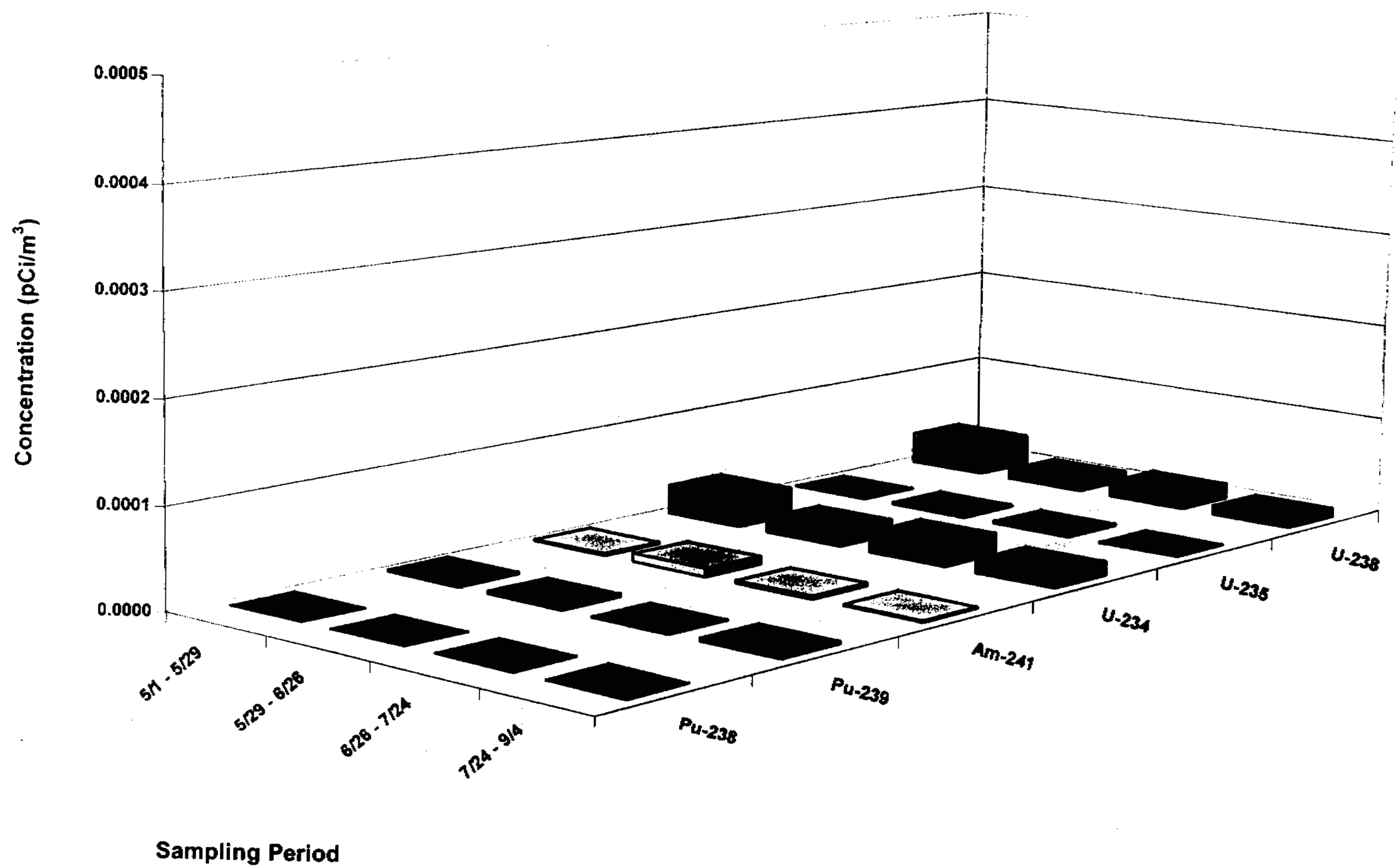

Figure 7

24

Trench 1
Air Samplers Inside Tent T1-A T1-B T1-C
(Alpha Screens)

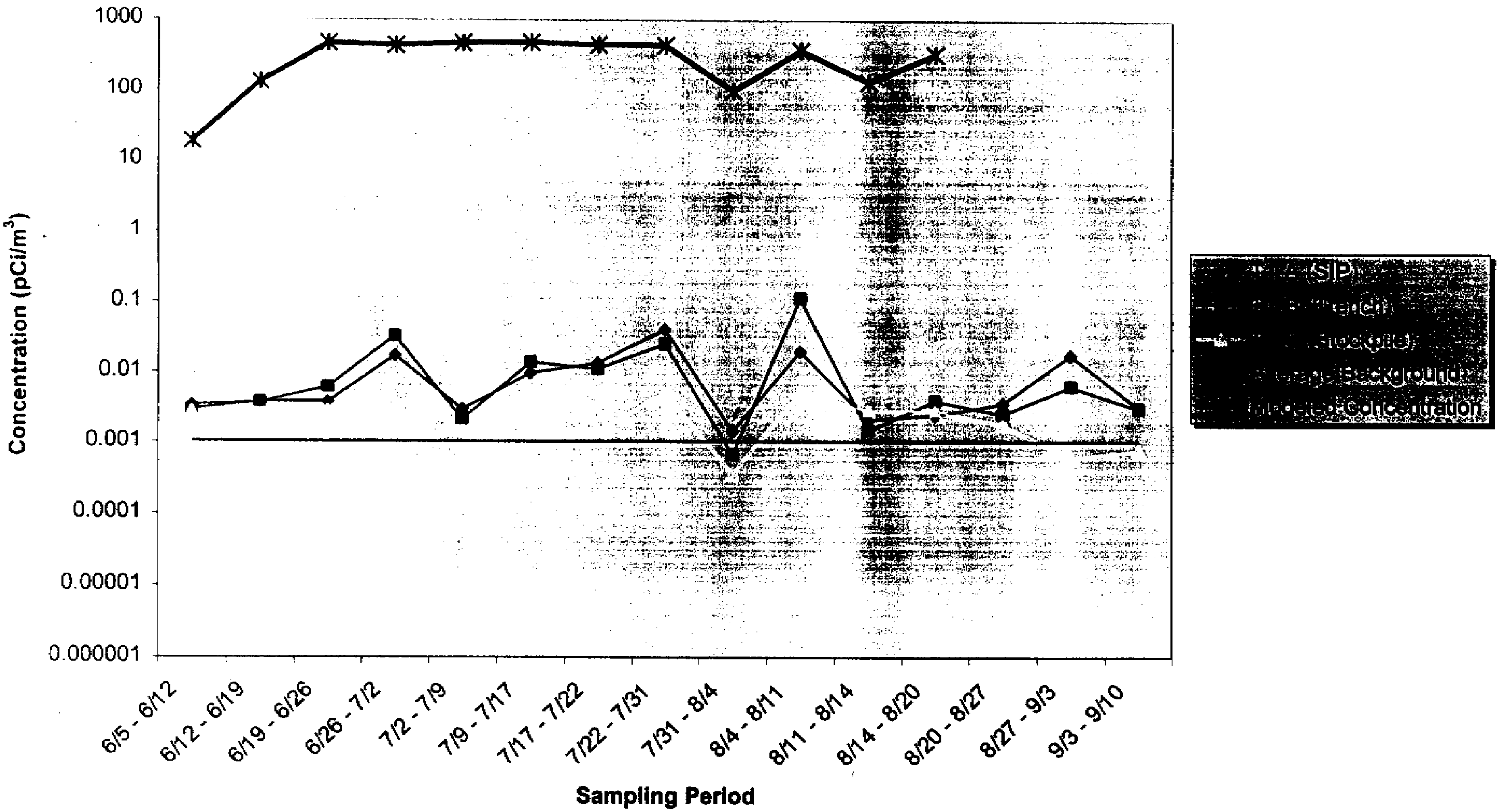

Figure 8

85

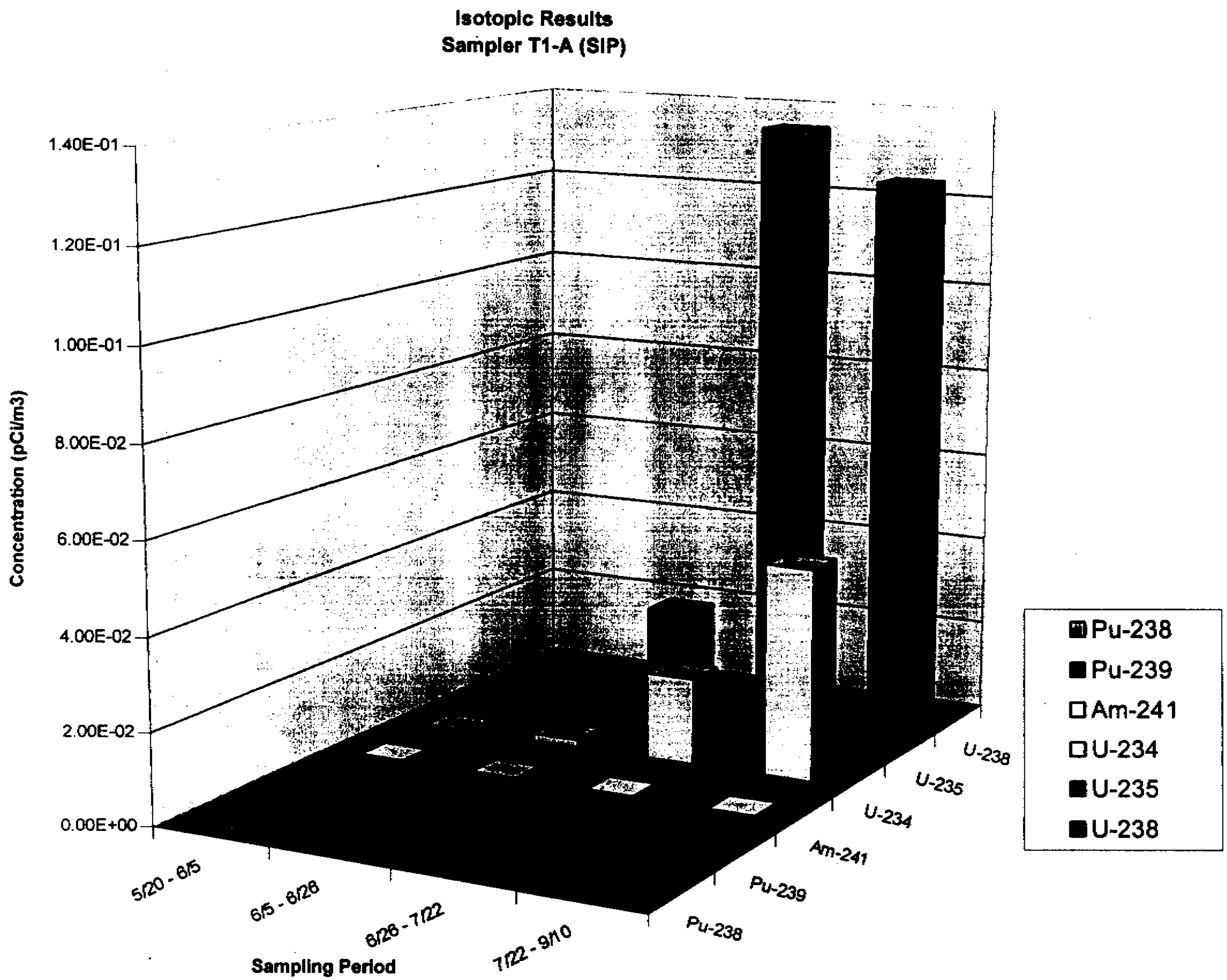
Isotopic Results
Sampler T1-A (SIP)
Concentration (pCi/m3)
1.40E-01
1.20E-01
1.00E-01
8.00E-02
6.00E-02
4.00E-02
2.00E-02
0.00E+00
5/20 - 6/5
6/5 - 6/26
6/26 - 7/22
7/22 - 9/10
Sampling Period
Pu-238
Pu-239
Am-241
U-234
U-235
U-238
Pu-238
Pu-239
Am-241
U-234
U-235
U-238

Figure 9

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Isotpic Results
Sampler T1-B (Trench)

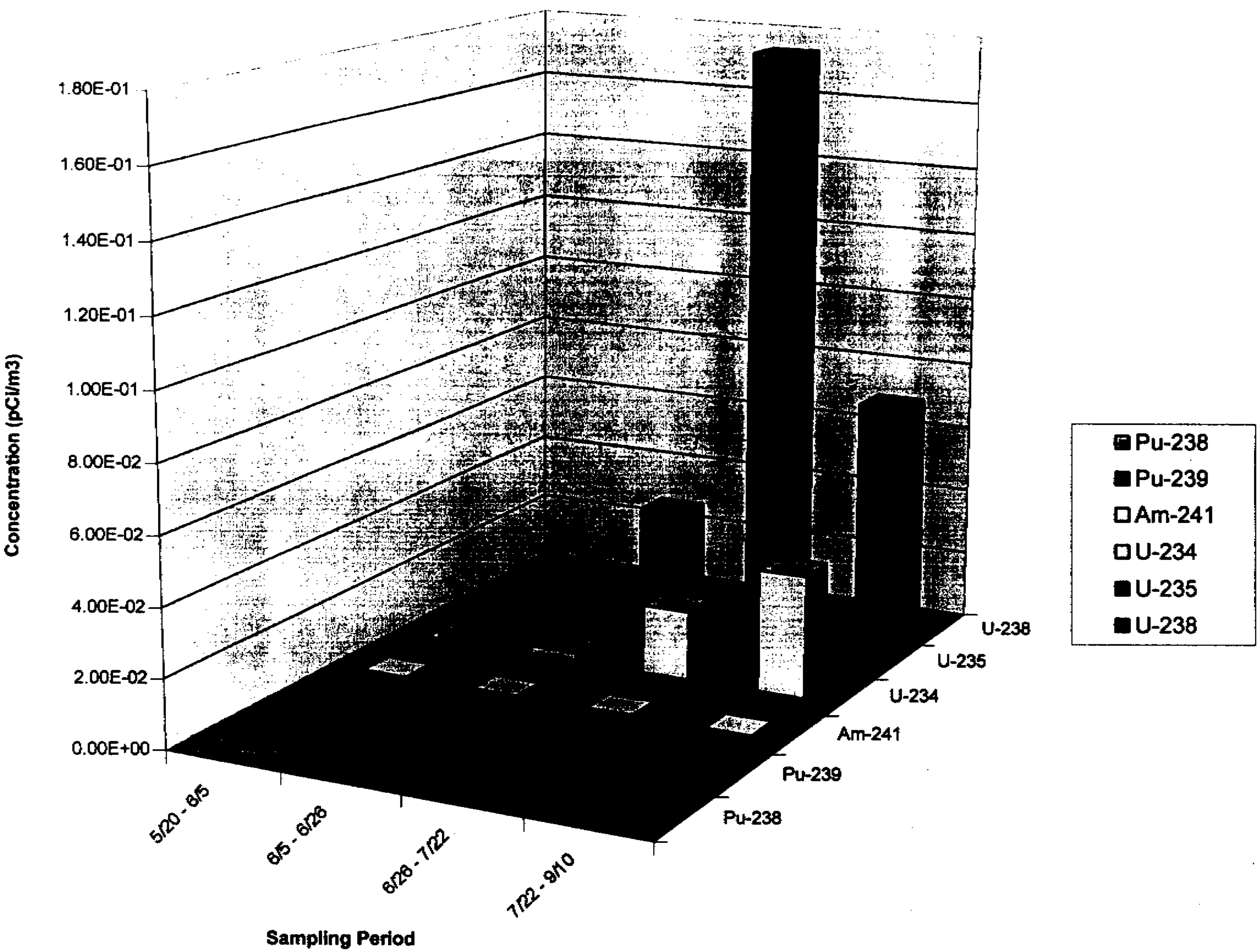

Figure 10

7

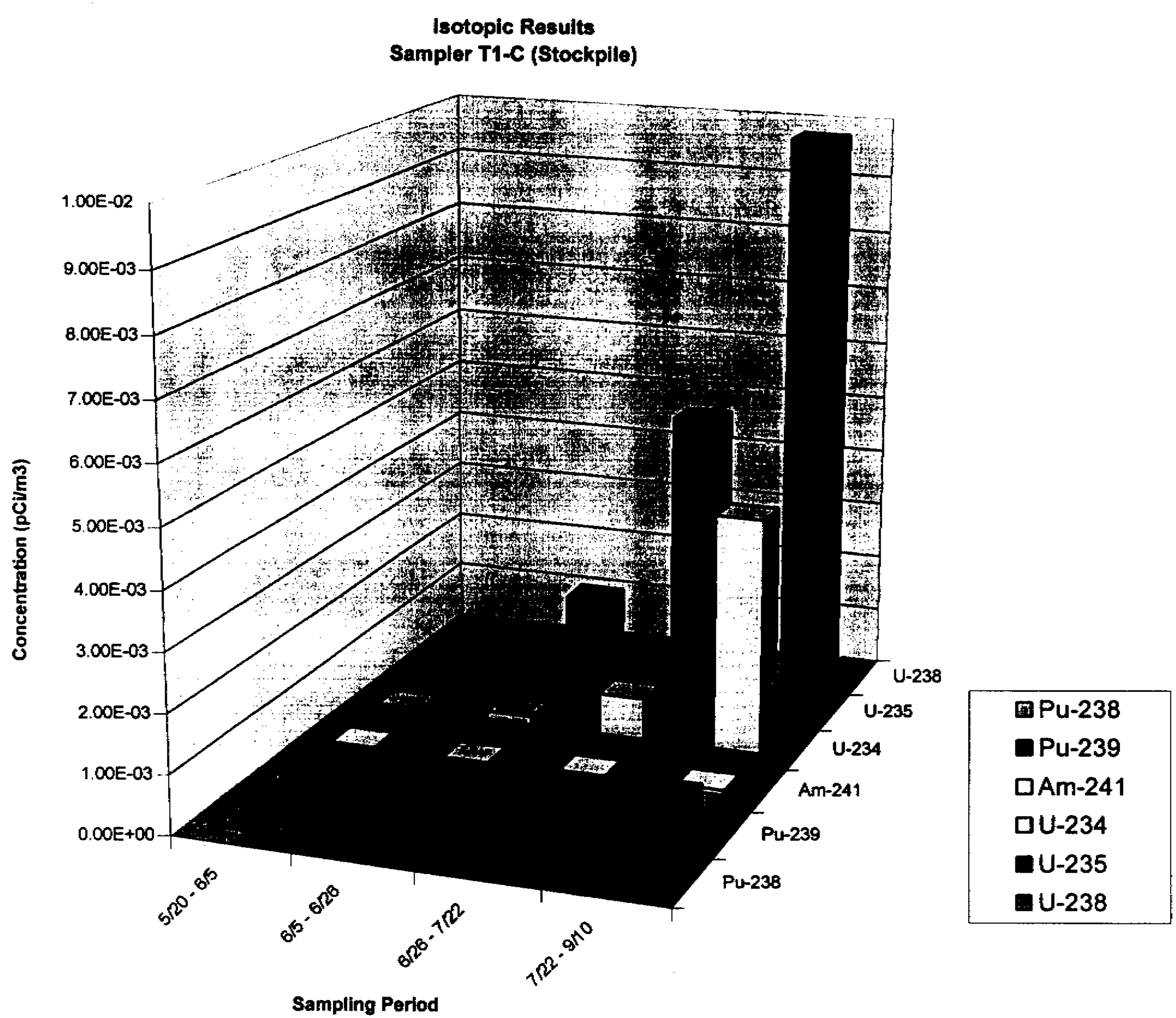
Isotopic Results
Sampler T1-C (Stockpile)
Concentration (pCi/m3)
1.00E-02
9.00E-03
8.00E-03
7.00E-03
6.00E-03
5.00E-03
4.00E-03
3.00E-03
2.00E-03
1.00E-03
0.00E+00
5/20 - 6/5
6/5 - 6/28
6/28 - 7/22
7/22 - 9/10
Sampling Period
U-238
U-235
U-234
Am-241
Pu-239
Pu-238
Pu-238
Pu-239
Am-241
U-234
U-235
U-238

Figure 11

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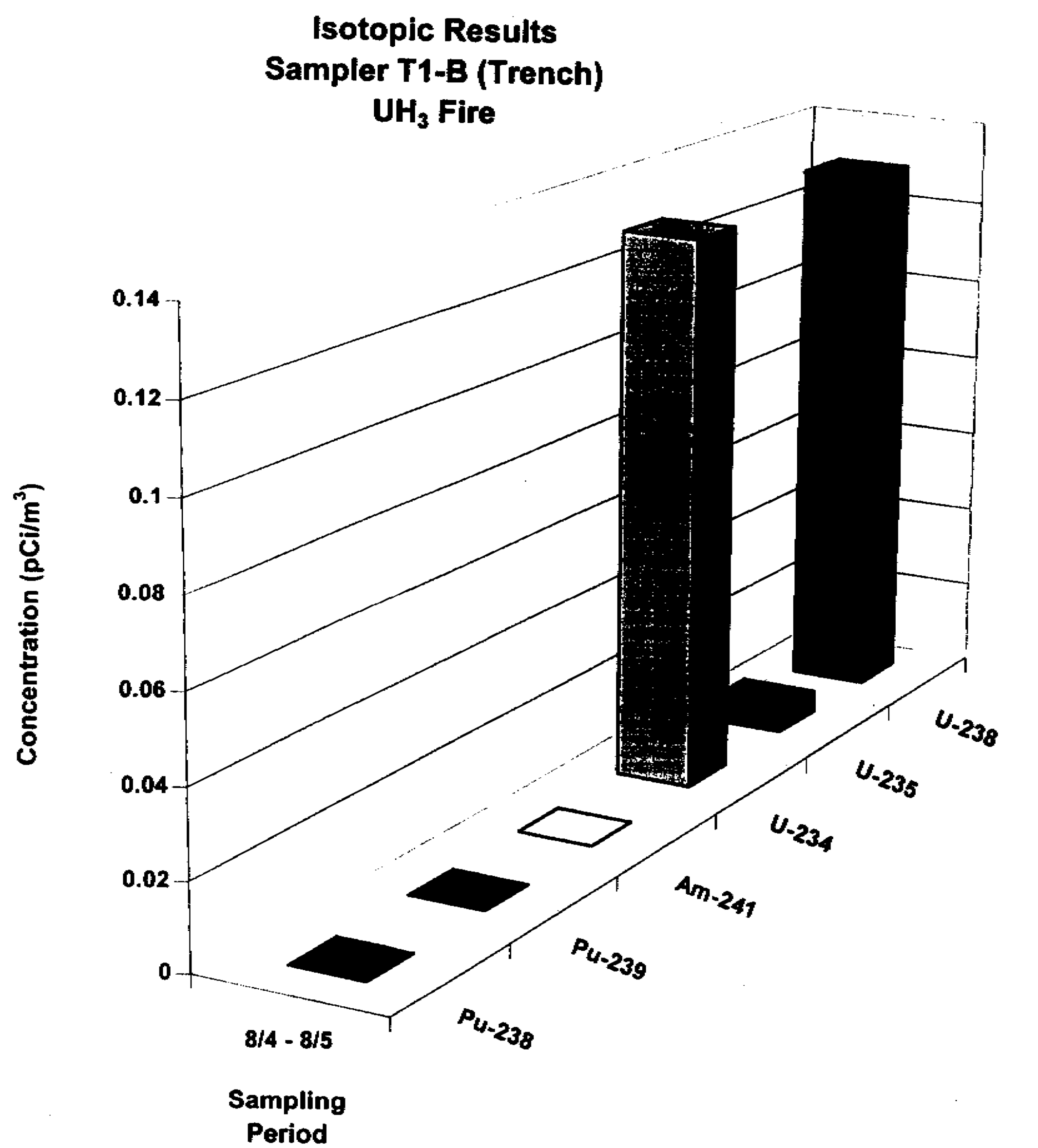
Isotopic Results
Sampler T1-B (Trench)
UH_3 Fire
Concentration (pCi/m^3)
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
8/4 - 8/5
Sampling Period
Pu-238
Pu-239
Am-241
U-234
U-235
U-238

Figure 12

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Tritium Results
Sampler T1-B (Trench)
UH_3 Fire

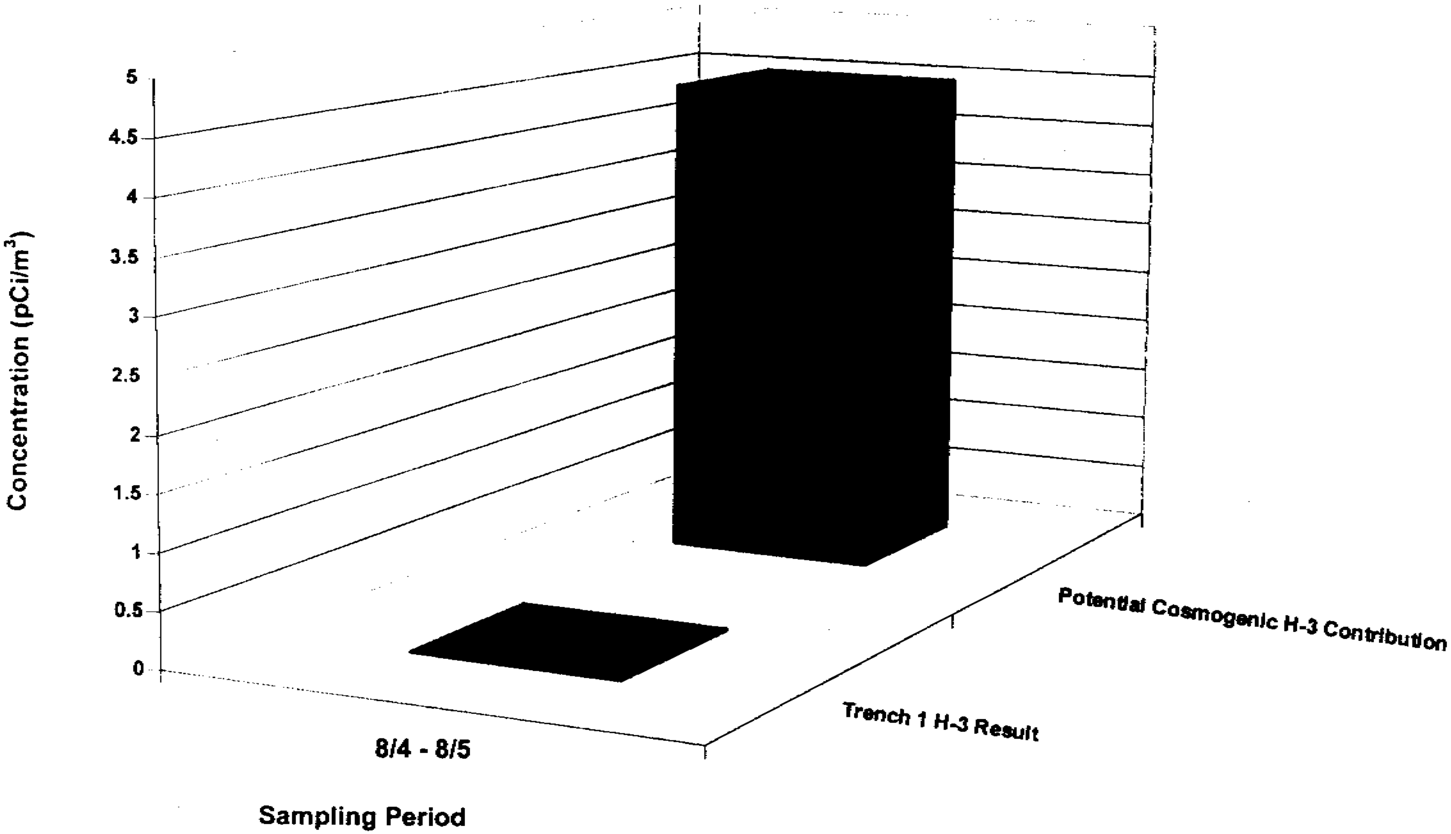
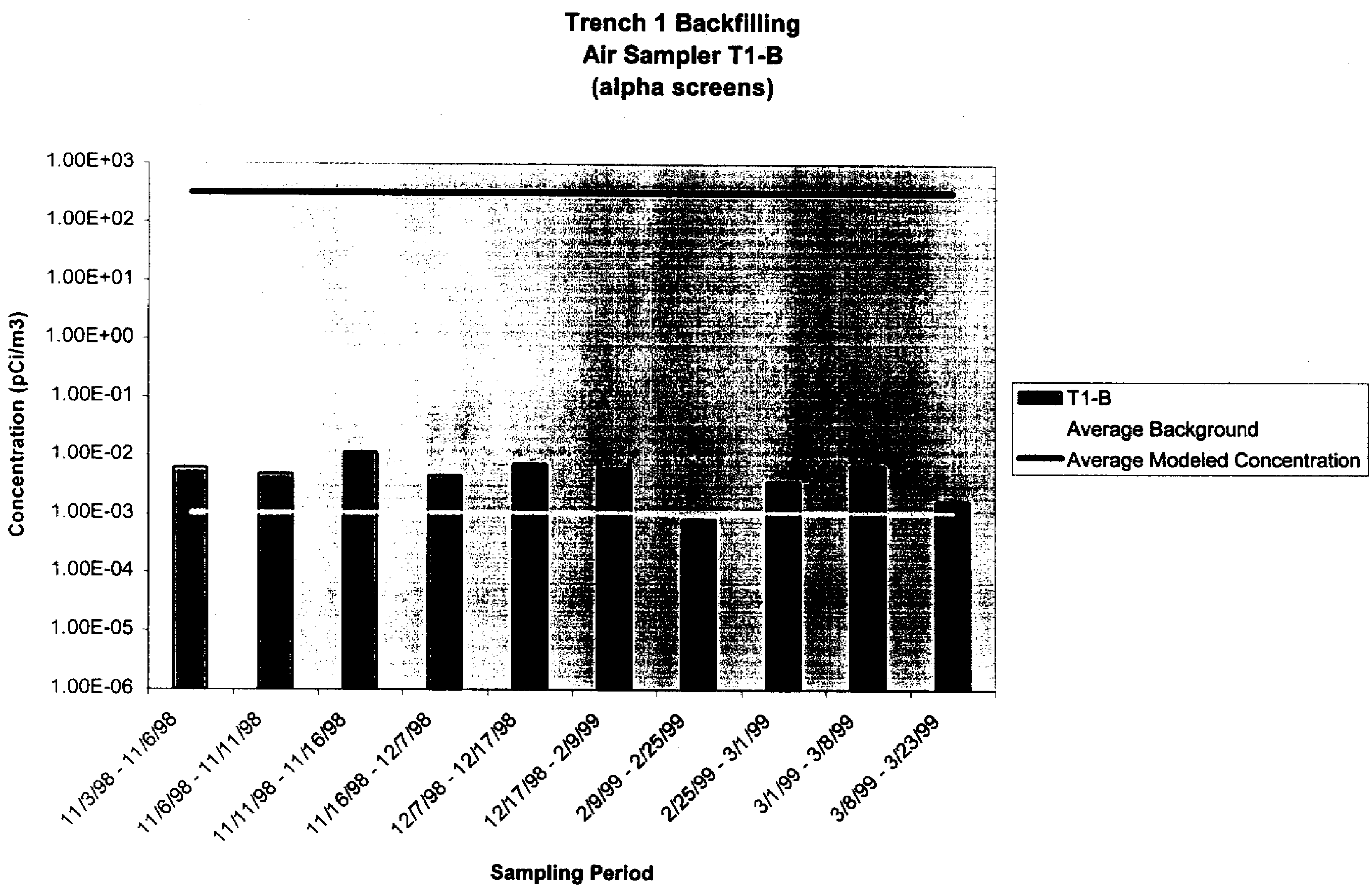


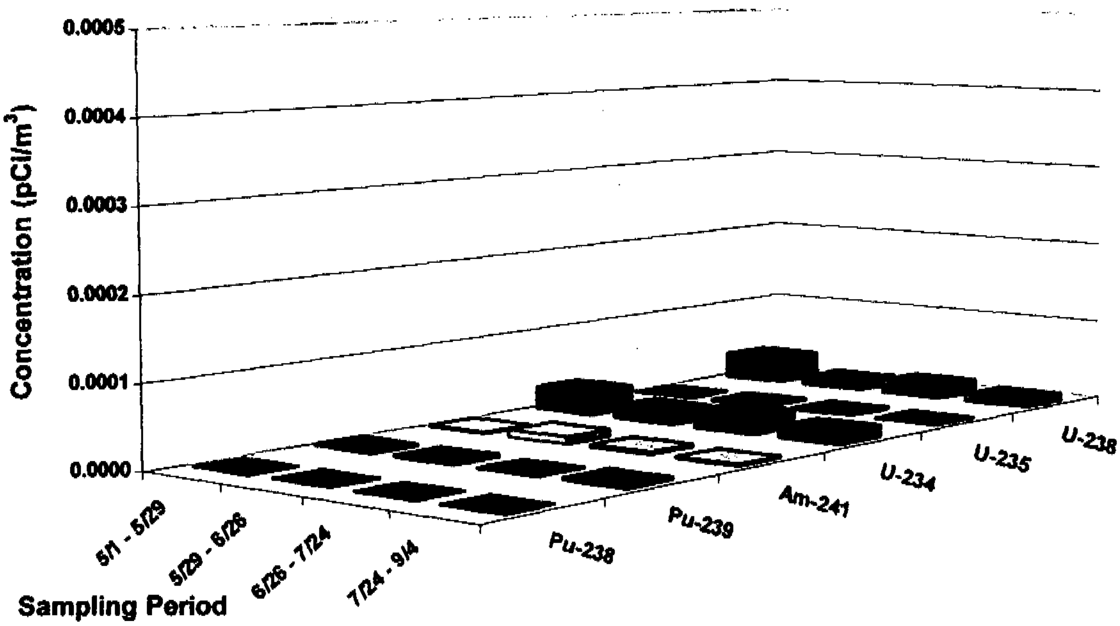
Figure 13



Trench 1 Backfilling
Air Sampler T1-B
(alpha screens)
Concentration (pCi/m3)
1.00E+03
1.00E+02
1.00E+01
1.00E+00
1.00E-01
1.00E-02
1.00E-03
1.00E-04
1.00E-05
1.00E-06
11/3/98 - 11/6/98
11/6/98 - 11/11/98
11/11/98 - 11/16/98
11/16/98 - 12/7/98
12/7/98 - 12/17/98
12/17/98 - 2/9/99
2/9/99 - 2/25/99
2/25/99 - 3/1/99
3/1/99 - 3/8/99
3/8/99 - 3/23/99
Sampling Period
T1-B
Average Background
Average Modeled Concentration

Figure 14

Isotopic Results
Sampler S-121 (Nearby Buffer Zone Sampler)



Isotopic Results
Sampler T1-B (Trench)

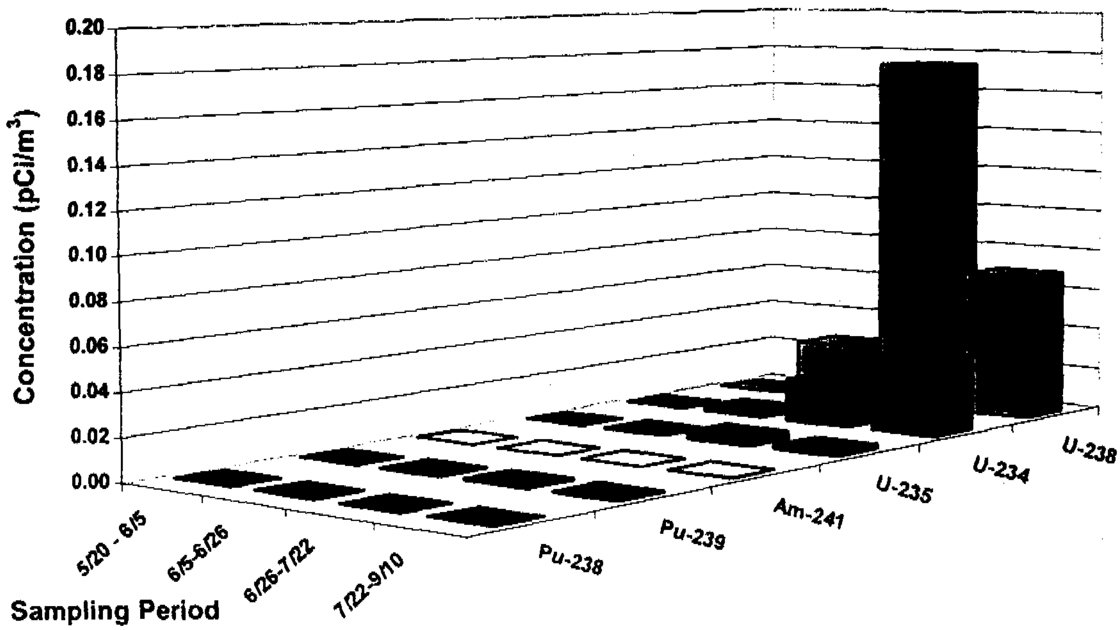


Figure 15

Appendix C
Information Regarding Backfilling of T-1
(Put Back Letters and List of IDM Drums Backfilled in T-1)

STATE OF COLORADO

Roy Romer, Governor
Patricia A. Nolan, MD, MPH, Executive Director

Dedicated to protecting and improving the health and environment of the people of Colorado

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Colorado Department
of Public Health
and Environment

Howard A. Roitman, Interim Division Director
Hazardous Materials & Waste Management Division

FAX TRANSMISSION SHEET
FAX #: 759-5355

IMMEDIATE DELIVERY TO: Gary Kleeman / Norma Castañeda / Tom Greengard / Lane Butler

COMPANY/AGENCY: EPA / DOE / K-H (SAIC) / K-H

TELEPHONE #:

TELEFAX #: 312-6067 / 966-4728 / 966-6406 / 966-640

FROM: Carl Spreng

TELEPHONE #:

SUBJECT: T1 alpha spec analyses (CDPHE lab)

DATE:

OF PAGES TO FOLLOW: 1

COMMENTS: Just received these yesterday. Some statistics accompanied these data, but we should probably wait to apply statistics till all the alpha spec data is in.

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COLORADO DEPT. OF PUBLIC HEALTH & ENVIRONMENT
Laboratory and Radiation Services Division
Radiation Counting Facility

Sample	ALPHA SPECTROMETRIC MEASUREMENTS					GAMMA SPECTROMETRIC MEASUREMENTS				
Number:	^{239}Pu	+ 95% CI	^{241}Am	+ 95% CI	Pu/Am ratio	^{239}Pu	+ 95% CI	^{241}Am	+ 95% CI	Pu/Am ratio
2112-002	1.12	0.09	0.17	0.06	6.6	2.66		0.60		4.4
2112-003	3.49	0.25	0.31	0.07	11.3	3.34		0.76		4.4
2112-008	1.48	0.12	0.56	0.11	2.6	5.19		1.18		4.4
2112-014	11.6	0.5	1.95	0.02	5.9	10.52		2.39		4.4
2111-001	<0.08		<0.08			2.23		0.51		4.4
2111-003	<0.02		<0.05			2.01		0.46		4.4
2111-011	<0.01		<0.29			1.93		0.44		4.4
2111-015	0.03	0.02	<0.13			2.02		0.46		4.4
2111-016	0.04	0.02	<0.04			1.94		0.44		4.4
2111-028	0.02	0.01	<0.07			1.78		0.40		4.5
2111-038	0.02	0.01	<0.03			1.90		0.43		4.4
2111-045	0.05	0.01	<0.07			2.05		0.47		4.4
average:					6.6					4.4

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VIII
999 18th STREET - SUITE 500
DENVER, COLORADO 80202-2466

Ref: EPR-F DEC 2 1998

Ms. Regina Sarter
Department of Energy
Rocky Flats Office
P.O. Box 928
Golden, CO 80402-0928

Re: Trench 1 Backfill

Dear Ms. Sarter:

EPA has reviewed the analytical data that were provided on diskettes in order to characterize the contents of the Investigative Derived Material (IDM) which DOE is proposing to use for backfill at Trench 1. This data is correlated to specific drums containing IDM which have been stored for a number of years at the site. The drums shall be emptied so that the contents can be used as backfill for Trench 1 or shipped offsite intact. The data that DOE has provided show that the contents of 2162 drums are acceptable for use as backfill, based on meeting the criteria of Rocky Flats Cleanup Agreement (RFCA) action levels for specific radionuclides and volatile organic compounds in subsurface soils. The specific files that were reviewed and that show detailed correlation of analytical results with drums are:

IDM3.mdb	Table: d-pass-both-detail	(977 drums)
IDM4.mdb	Table: d-pass-rad-detail	(122 drums)
IDM4.mdb	Table: d-pass-voc-detail	(502 drums)
Nov9su~1.xls		(561 drums)
		(Total 2162 drums)

In our meeting on November 18, 1998, it was stated that 108 of the 2162 drums were listed more than once in the data tables, so that the total number of unique drums meeting the criteria was 2054. In addition, it was stated that 612 of these drums had already been or will be shipped offsite for disposal, leaving 1442 drums that meet the criteria and will be used as backfill for Trench 1. Since this data was correlated in stages and provided in multiple tables of various formats, EPA repeats its request that DOE provide a summary report of the entire process. This report will enable all parties to track the disposition of these materials with less difficulty and shall list each drum in numerical order for the following categories:

1) IDM drums to be used for backfill at Trench 1
2) IDM drums already shipped offsite
3) IDM drums to be shipped offsite in the future
4) IDM drums disqualified from backfill list
5) Other IDM drums (drums for which data was not correlated)

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As a result of our independent review of the data provided, EPA approves DOE's request to backfill Trench 1 with the contents of drums that meet the criteria of RFCA subsurface action levels for radionuclides and volatile organic compounds as documented in the files listed above.

EPA has also recently received and reviewed the alpha spectrometry analytical results for radionuclides of samples from the excavation boundaries of Trench 1 (bottom and sidewalls) and its clean soil stockpile. These 29 analyses, in combination with 12 analyses that were performed by the Colorado Department of Public Health and Environment at its Radiation Counting Facility, confirm the results previously obtained by DOE using gamma spectrometry for the same samples. As a result, EPA finds that the Trench 1 excavation boundaries and clean soil stockpile meet RFCA action levels and therefore, DOE may commence backfilling Trench 1 with these soils.

If you have any comments or questions regarding these matters, please contact Gary Kleeman at 312-6246.

Sincerely,

Tim Rehder

Tim Rehder, Manager
Rocky Flats Project

cc: Reg Tyler, DOE
Carl Spreng, CDPHE
Lane Butler, Kaiser-Hill
Dave Shelton, Kaiser-Hill

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Department of Energy

ROCKY FLATS FIELD OFFICE
P.O. BOX 928
GOLDEN, COLORADO 80402-0928

DEC 7 1998

98-DOE-03881

Mr. Tim Rehder
U.S. Environmental Protection Agency, Region VIII
999 18th Street, Suite 500 8EPR-FT
Denver, Colorado 80202-2466

Mr. Steve Gunderson
Colorado Department of Public Health and the Environment
4300 Cherry Creek Drive South
Denver, Colorado 80222-1530

Gentlemen:

As was recently discussed with you, the U.S. Department of Energy (DOE) Rocky Flats Field Office intends to make a field modification to the Trench 1 work. The Proposed Action Memorandum for Trench 1 states the trench will be backfilled with excavated material that has radionuclide activity levels below Rocky Flats Cleanup Agreement Tier II action levels and with volatile organic chemicals below Tier I. With your agreement, DOE has directed its contractor to backfill the trench with investigative derived material soils that meet these criteria. This action does not compromise safety or protection of public health or the environment. The analytical and radiochemistry results data provided to your agencies to date are acceptable for "put-back" into Trench 1. This field modification will be documented in the Trench 1 Closeout Report

If you should have any technical questions regarding this transmittal, please contact Norma I. Castaneda at (303) 966-4226 or contact me at (303) 966-5918.

Sincerely,

Joseph A. Legare

Joseph A. Legare
RFCA Project Coordinator

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RFETS IDM Drums Listed by WEMS Number Used as Backfill at Trench-1 (11/3/98 - 12/15/98)

E00065	E00051	E02572	E00100	E02084	E03079	E00058	E02576	E04568
E00093	E00056	E02582	E00104	E02093	E03083	E00092	E02643	E04581
E00095	E00059	E02646	E00105	E02097	E03135	E00126	E02663	E04607
E00101	E00063	E02750	E00111	E02106	E03136	E00128	E02677	E00009
E00102	E00094	E02808	E00113	E02109	E03149	E00209	E02714	E00013
E00114	E00097	E02809	E00133	E02118	E03458	E00266	E02717	E00033
E00117	E00098	E02899	E00134	E02178	E03693	E00346	E02720	E00045
E00124	E00106	E02983	E00135	E02187	E03840	E00348	E02721	E00047
E00125	E00118	E03077	E00136	E02189	E04169	E00355	E02806	E00112
E00127	E00343	E03081	E00224	E02195	E04177	E00357	E02860	E00159
E00137	E00379	E03088	E00225	E02200	E04196	E00364	E02878	E00160
E00229	E00411	E03137	E00230	E02219	E04204	E00501	E02884	E00189
E00353	E00656	E03138	E00304	E02220	E04209	E00689	E03000	E00198
E00392	E00658	E03158	E00330	E02221	E04290	E00699	E03003	E00232
E00410	E00668	E03163	E00344	E02367	E04367	E00707	E03004	E00435
E00787	E00670	E03342	E00345	E02371	E04401	E00709	E03006	E00688
E00987	E00681	E03369	E00349	E02391	E04430	E00711	E03062	E00701
E01428	E00704	E04167	E00351	E02392	E04445	E00716	E03063	E00721
E01996	E00706	E04175	E00365	E02494	E04448	E00717	E03070	E01557
E01998	E00713	E04285	E00386	E02512	E04452	E01015	E03090	E01565
E02184	E00719	E04286	E00408	E02527	E04453	E01045	E03133	E01692
E02384	E00720	E04289	E00652	E02537	E04457	E01261	E03134	E01716
E02598	E00730	E04291	E00659	E02566	E04458	E01555	E03144	E01999
E02686	E00752	E04359	E00675	E02569	E04459	E01560	E03145	E02044
E02723	E00801	E04441	E00680	E02574	E04461	E01566	E03146	E02054
E02749	E00874	E04442	E00693	E02575	E04467	E01717	E03147	E02067
E02763	E01243	E04444	E00695	E02580	E04468	E02058	E03148	E02114
E02882	E01434	E04455	E00698	E02599	E04477	E02061	E03151	E02202
E02901	E01435	E04490	E00700	E02637	E04478	E02105	E03162	E02204
E02985	E01997	E04492	E00714	E02644	E04480	E02119	E03490	E02205
E02987	E02038	E04493	E00715	E02645	E04489	E02201	E03695	E02389
E02990	E02062	E04496	E00739	E02647	E04494	E02203	E03698	E02393
E03082	E02071	E04502	E00788	E02665	E04495	E02368	E03746	E02409
E03343	E02098	E04504	E00789	E02679	E04499	E02375	E03841	E02411
E03694	E02107	E04512	E00791	E02715	E04500	E02390	E03842	E02420
E03696	E02181	E04552	E00875	E02718	E04501	E02402	E03894	E02429
E03697	E02183	E04560	E00876	E02719	E04509	E02410	E04143	E02433
E03700	E02185	E04562	E00984	E02722	E04510	E02415	E04368	E02434
E04184	E02186	E04563	E00985	E02726	E04513	E02421	E04383	E02435
E04194	E02188	E04566	E01244	E02752	E04524	E02430	E04404	E02437
E04287	E02190	E04598	E01688	E02798	E04564	E02438	E04425	E02440
E04288	E02192	E04606	E01991	E02800	E04580	E02446	E04446	E02442
E04314	E02194	E00011	E02009	E02807	E04599	E02455	E04447	E02448
E04460	E02351	E00029	E02034	E02879	E04601	E02483	E04449	E02458
E00002	E02363	E00034	E02046	E02891	E04602	E02508	E04454	E02462
E00027	E02383	E00036	E02049	E02892	E04608	E02509	E04470	E02480
E00028	E02386	E00041	E02060	E02898	E00030	E02513	E04472	E02481
E00031	E02496	E00043	E02064	E02900	E00035	E02535	E04475	E02486
E00032	E02533	E00057	E02069	E02996	E00049	E02536	E04476	E02488
E00044	E02568	E00062	E02070	E03059	E00054	E02573	E04565	E02491

RFETS IDM Drums Listed by WEMS Number Used as Backfill at Trench-1 (11/3/98 - 12/15/98)

E02499	E03653	E00795	E02485	E03874	E00213	E00676	E02959	E04299
E02504	E03740	E00796	E02487	E03875	E00233	E00907	E02961	E04320
E02505	E03752	E00797	E02502	E03887	E00234	E00915	E02963	E04639
E02515	E03888	E00798	E02503	E03893	E00246	E00921	E02964	E00085
E02519	E03889	E00800	E02526	E03895	E00261	E00923	E03010	E00398
E02522	E03892	E00852	E02528	E04166	E00264	E00924	E03030	E00409
E02524	E04144	E00853	E02530	E04168	E00265	E00944	E03096	E00415
E02529	E04178	E00871	E02571	E04280	E00269	E01063	E03103	E00684
E02531	E04179	E00888	E02636	E04363	E00271	E01102	E03107	E00913
E02579	E04180	E01016	E02640	E04466	E00272	E01135	E03112	E00922
E02586	E04181	E01023	E02641	E04473	E00274	E01138	E03141	E00952
E02600	E04182	E01025	E02649	E00108	E00277	E01168	E03307	E00972
E02635	E04183	E01036	E02658	E00109	E00103	E01191	E03308	E00974
E02642	E04185	E01042	E02660	E00116	E00175	E01196	E03346	E01064
E02648	E04186	E01043	E02666	E00158	E00205	E01208	E03423	E01067
E02655	E04187	E01044	E02676	E00166	E00096	E01212	E03429	E01068
E02659	E04188	E01056	E02687	E00207	E00110	E01217	E03444	E01080
E02664	E04189	E01057	E02705	E00208	E00122	E01220	E03447	E01100
E02669	E04190	E01059	E02716	E00214	E00129	E01222	E03452	E01104
E02672	E04191	E01227	E02728	E00217	E00171	E01235	E03500	E01140
E02690	E04192	E01228	E02729	E00227	E00184	E01236	E03520	E01150
E02694	E04193	E01242	E02980	E0237	E00187	E01237	E03521	E01167
E02710	E04205	E01260	E02981	E00250	E00188	E01245	E03560	E01173
E02712	E04210	E01262	E02982	E00263	E00212	E01246	E03566	E01174
E02732	E04213	E01433	E02984	E00793	E00221	E01247	E03601	E01178
E02733	E04214	E01438	E02986	E00799	E00226	E01248	E03612	E01189
E02734	E04279	E01444	E02988	E00815	E00228	E01265	E03613	E01190
E02802	E04356	E01467	E02989	E00870	E00251	E01266	E03614	E01195
E02859	E04358	E01468	E02991	E01019	E00255	E01437	E03638	*E01196*
E02877	E04360	E01469	E02994	E01037	E00276	E01664	E03671	E01199
E02997	E04443	E01492	E03058	E01241	E00284	E01684	E03672	E01211
E02998	E00001	E01536	E03078	E01426	E00025	E01748	E03681	E01268
E03001	E00018	E01556	E03084	E01427	E00216	E02077	E03687	E01283
E03005	E00153	E01562	E03143	E01439	E00223	E02128	E03709	E01316
E03057	E00154	E01642	E03457	E01466	E00243	E02132	E04021	E01646
E03080	E00155	E01677	E03488	E01491	E00247	E02364	E04040	E01714
E03086	E00161	E01698	E03495	E02000	E00254	E02379	E04042	E01737
E03089	E00168	E01724	E03504	E02042	E00270	E02399	E04147	E01807
E03142	E00169	E01728	E03506	E02584	E00139	E02400	E04151	E02116
E03171	E00170	E01739	E03512	E03871	E02082	E02482	E04160	E02134
E03392	E00197	E01745	E03513	E03886	E00199	E02493	E04170	E02146
E03473	E00231	E01750	E03514	E03890	E00292	E02517	E04195	E02148
E03475	E00235	E01779	E03515	E03891	E00298	E02520	E04221	E02150
E03493	E00238	E01781	E03549	E00099	E00329	E02759	E04240	E02152
E03497	E00444	E01912	E03702	E00115	E00332	E02767	E04256	E02362
E03498	E00576	E02095	E03741	E00183	E00336	E02782	E04270	E02450
E03499	E00753	E02380	E03745	E00203	E00394	E02783	E04272	E02498
E03502	E00759	E02439	E03870	E00204	E00400	E02784	E04273	E02521
E03505	E00774	E02461	E03872	E00206	E00401	E02841	E04281	E02523
E03507	E00775	E02484	E03873	E00211	E00403	E02955	E04297	E02534

RFETS IDM Drums Listed by WEMS Number Used as Backfill at Trench-1 (11/3/98 - 12/15/98)

E02539	E00370	E02793	E00491	E03509	E01183	E04634	E00911	*E02699*
E02668	E00371	E02801	E00654	E03510	E01184	E04640	E00912	E02753
E02707	E00372	E02812	E00673	E03511	E01194	E00067	E00914	E02774
E02713	E00397	E02958	E00677	E03516	E01206	E00086	*E00937*	E02781
E02814	E00904	E02962	E00679	E03517	E01218	E00201	E00943	E02796
E02954	E00906	E02993	E00900	E03525	E01240	E00202	E00946	E02803
E02957	E00908	E03013	E00902	E03528	E01249	E00249	E00951	E02813
E02965	E00910	E03022	E00919	E03686	E01288	E00841	E00966	E02833
E02976	E00916	E03068	E00920	E03699	E01304	E00885	E00969	E02837
E02977	E00917	E03099	E00926	E03851	E01672	E01027	E00973	E02842
E03007	E00918	E03109	E00928	E03855	E01683	E02126	E00978	*E02843*
E03020	E00925	E03460	E00940	E03857	E01693	*E02575*	E01028	E02845
E03097	E00927	E03461	E00942	E03863	E01993	E02587	E01030	E02852
E03098	E00929	E03478	E00950	E03865	E01995	E03405	E01034	E03218
E03100	E00954	E03519	E01070	E04043	E02013	E03433	E01035	E03266
E03104	E00958	E03522	E01072	E04048	E02078	E03438	E01047	E03345
E03106	E00962	E03534	E01086	E04050	E02079	E03439	E01049	E03422
E03114	E00965	E03676	E01141	E04059	E02138	E03445	E01050	E03428
E03121	E01051	E03678	E01144	E04062	E02516	E03446	E01078	E03440
E03122	E01054	E03701	E01146	E04137	E03008	E03451	E01081	E03527
E03124	E01075	E03718	E01161	E04271	E03154	E03453	E01097	E03535
E03367	E01076	E03722	E01180	E04309	E03268	E03455	E01137	E03569
E03368	E01093	E03723	E01182	E04310	E03269	E03600	E01139	E03586
E03403	E01101	E03847	E01186	E04321	E03302	E03670	E01142	E03587
E03434	E01103	E03848	E01197	E00260	E03304	E03716	E01155	E03588
E03448	E01136	E03859	E01202	E00279	E03309	E03719	E01162	E03607
E03449	E01147	E03860	E01213	E00323	E03397	E03720	E01165	E03608
E03450	E01153	E03864	E01214	E00339	E03401	E03763	E01169	E03615
E03561	E01154	E03876	E01215	E00381	E03408	E04308	E01170	E03622
E03564	E01159	E03975	E01321	E00419	E03431	E04349	E01172	E03635
E03602	E01163	E03976	E01518	E00682	E03443	E04352	E01185	E03688
E03849	E01179	E04008	E01804	E00903	E03523	E00119	E01198	E03710
E03858	E01187	E04009	E01806	E00905	E03524	E00313	E01200	E03721
E03941	E01201	E04053	E02139	E00909	E03526	E00317	E01203	E03724
E04007	E01204	E04135	E02725	E01026	E03536	E00334	E01219	E03854
E04022	E01221	E04150	E02756	E01033	E03567	E00337	E01230	E03862
E04024	E01281	E04154	E02758	E01065	E03589	E00341	E01303	E03877
E04148	E01282	E04159	E02773	E01066	E03717	E00358	E01453	E03978
E04153	E01285	E04164	E02779	E01069	E03856	E00363	E01666	E03979
E04155	E01287	E04174	E02785	E01079	E04004	E00373	E01668	E03980
E04157	E01805	E04211	E02804	E01085	E04006	E00374	E01690	E03981
E04158	E02017	E04525	E02816	E01094	E04094	E00375	E01691	E03982
E04161	E02131	E04638	E02834	E01096	E04173	E00378	E01803	E03983
E04282	E02143	E00319	E02839	E01099	E04301	E00382	E02108	E03984
E04298	E02149	E00335	E02880	E01143	E04311	E00405	E02125	E03985
E04350	E02153	E00340	E03002	E01145	E04351	E00406	E02129	E04005
E04353	E02760	E00342	E03087	E01152	E04617	E00802	E02133	E04061
E00321	E02762	E00396	E03300	E01171	E04618	E00892	*E02191*	E04172
E00359	E02769	E00402	E03344	E01175	E04623	*E00899*	*E02193*	E04203
E00362	E02770	E00420	E03508	E01181	E04624	E00901	E02601	E04296

RFETS IDM Drums Listed by WEMS Number Used as Backfill at Trench-1 (11/3/98 - 12/15/98)

E04300	E02940
E04334	E02941
E04388	E02942
E04465	E02943
E04536	E02944
E04537	E02945
E04546	E02973
E00123	E03281
E00138	E03282
E00141	E03283
E00178	E03325
E00195	E03326
E00196	E03327
E00200	E03329
E00222	E03330
E00280	E03331
E00286	E03336
E00287	E03338
E00803	E03339
E00840	E03407
E00890	E03421
E01031	E03438
E01048	E03454
E01052	E03465
E01055	E03565
E01670	E03577
E01675	E03579
E02004	E03611
E02008	E04171
E02010	E04312
E02011	E04335
E02022	E04336
E02894	*E04347*
E02895	E04545
E02896	
E02904	
E02922	
E02923	
E02924	
E02925	
E02930	
E02931	
E02932	
E02933	
E02934	
E02935	
E02936	
E02937	
E02938	
E02939	

NOTES: Drum # E02379 was first recorded as dumped on 11/16/98, a drum by the same number was recorded as dumped on 12/3/98. It is assumed that the drum previously dumped on 11/16 was actually drum # E00237

Appendix D
T-1 Waste Information

Appendix D-1	T-1 Waste Container Inventories (including initial and secondary overpack correlations)
Appendix D-2	T-1 Depleted Uranium Gamma Spectroscopy Data, Descriptions of Samples and Radioactive Material Type Determination Spreadsheet
Appendix D-3	T-1 Decanted Lathe Coolant Information
Appendix D-4	T-1 Cemented Cyanide Reclassification Letter

Appendix D-1
T-1 Waste Container Inventories
(including initial and secondary overpack correlations)

104

TRENCH 1 WASTE CONTAINERS

Container Type	WEM's No.	IDC	Fill (set-up) Date	weight (lbs) prior to inerting	weight (lbs) after inerting	Final Shipping Weight (lbs)	Traveler	Overpack Container No.	Notes
55 gallon drum	X07935	952						N/A	lathe coolant <15 gallons
55 gallon drum	D87711	325	9/8/98	N/A	N/A	112	yes	needs overpack?	
83 gallon overpack	X09845	483	6/25/98	?	?	1562	?	SPECIAL	some of the contents from X09845 removed and put into D87705 (SEE X09860), MP to locate Traveler
83 gallon overpack	X09846	483	7/7/98	520	643	721	yes	D87702 (55 gal.)	non-intact
83 gallon overpack	X09847	483	7/9/98	283	515	593	yes	D88411 (55 gal.)	
83 gallon overpack	X09848	483	7/9/98	368	601	679	yes	D88420 (55 gal.)	
83 gallon overpack	X09849	483	7/8/98	304	574	652	yes	D88410 (55 gal.)	
83 gallon overpack	X09853	483	6/30/98	1204	1580	1658	yes	SPECIAL	requires overpacking
83 gallon overpack	X09858	483	7/9/98	288	550	628	yes	D88412 (55 gal.)	
83 gallon overpack	X09859	483	7/9/98	392	653	731	yes	D87710 (55 gal.)	
83 gallon overpack	X09860	483	6/30/98	348.5	873	951	yes	D87705 (55 gal.)	some of the contents from X09845 removed and put into D87705
83 gallon overpack	X09873	483	7/9/98	531	657	735	yes	D88416 (55 gal.)	
83 gallon overpack	X09879	483	6/30/98	1270	1525	1603	yes	SPECIAL	requires overpacking
83 gallon overpack	X09889	483	7/9/98	440	592	670	yes	D88405 (55 gal.)	
83 gallon overpack	X09891	483	7/9/98	449	539	617	yes	D92861 (55 gal.)	
83 gallon overpack	X09892	483	7/8/98	356	440	518	yes	D88418 (55 gal.)	
83 gallon overpack	X09895	483	7/22/98	330	593	671	yes	D93280 (55 gal.)	
83 gallon overpack	X09896	483	7/21/98	305	517	595	yes	D93281 (55 gal.)	
83 gallon overpack	X09897	483	7/21/98	275	555	633	yes	D93275 (55 gal.)	
83 gallon overpack	X09898	483	7/20/98	401	486	564	yes	D93266 (55 gal.)	
83 gallon overpack	X09899	483	7/22/98	376	595	673	yes	D93283 (55 gal.)	
83 gallon overpack	X09900	483	7/21/98	368	647	725	yes	D93261 (55 gal.)	
83 gallon overpack	X09901	483	7/21/98	319	476	554	yes	D93263 (55 gal.)	
83 gallon overpack	X09902	483	7/22/98	380	543	621	yes	D93288 (55 gal.)	
83 gallon overpack	X09903	325	8/14/98	need wt	need wt	#VALUE!	yes	N/A	won't overpack, LLM/cemented cyanide/ACM - contaminated PPE and sample equipment
83 gallon overpack	X10875	483	7/22/98	470	N/A	716	yes	D93286 (55 gal.)	
83 gallon overpack	X10876	483	7/21/98	261	541	619	yes	D93260 (55 gal.)	
83 gallon overpack	X10877	483	7/22/98	297	525	603	yes	D93267 (55 gal.)	
83 gallon overpack	X10878	483	7/30/98	244	410	488	yes	D93457 (55 gal.)	
83 gallon overpack	X10879	483	7/20/98	445	633	711	yes	D93270 (55 gal.)	
83 gallon overpack	X10880	483	7/21/98	305	460	538	yes	D93273 (55 gal.)	
83 gallon overpack	X10882	483	7/22/98	327	636	714	yes	D93284 (55 gal.)	

TRENCH 1 WASTE CONTAINERS

Container Type	WEM's No.	IDC	Fill (set-up) Date	weight (lbs) prior to inerting	weight (lbs) after inerting	Final Shipping Weight (lbs)	Traveler	Overpack Container No.	Notes
83 gallon overpack	X10883	483	7/22/98	294	441	519	yes	D93285 (55 gal.)	
83 gallon overpack	X10884	483	7/21/98	427	549	627	yes	D93268 (55 gal.)	
83 gallon overpack	X10885	483	7/20/98	253	519	597	yes	D93274 (55 gal.)	
83 gallon overpack	X10886	483	7/22/98	259	545	623	yes	D93277 (55 gal.)	
83 gallon overpack	X10887	483	7/22/98	314	427	505	yes	D93287 (55 gal.)	
83 gallon overpack	X10888	483	7/22/98	405	520	598	yes	D93272 (55 gal.)	
83 gallon overpack	X10889	483	7/20/98	317	462	540	yes	D93271 (55 gal.)	
83 gallon overpack	X10890	483	7/21/98	554	616	694	yes	D93259 (55 gal.)	
83 gallon overpack	X10891	483	7/21/98	381	491	569	yes	D93282 (55 gal.)	
83 gallon overpack	X10892	483	7/20/98	269	475	553	yes	D93276 (55 gal.)	
83 gallon overpack	X10893	483	7/22/98	296	542	620	yes	D93279 (55 gal.)	
83 gallon overpack	X10894	483	7/21/98	368	613	691	yes	D93265 (55 gal.)	
83 gallon overpack	X10895	483	7/22/98	293	563	641	yes	D93278 (55 gal.)	
83 gallon overpack	X10896	483	7/28/98	541	707	785	yes	D93450 (55 gal.)	
83 gallon overpack	X10897	483	7/21/98	346	618	696	yes	D92867 (55 gal.)	
83 gallon overpack	X10898	483	7/21/98	380	498	576	yes	D92856 (55 gal.)	
83 gallon overpack	X10899	483	7/13/98	287	572	650	yes	D92865 (55 gal.)	
83 gallon overpack	X10900	483	7/14/98	338	577	655	yes	D92871 (55 gal.)	
83 gallon overpack	X10901	483	7/14/98	303	501	579	yes	D92866 (55 gal.)	
83 gallon overpack	X10902	483	7/13/98	331	477	555	yes	D92868 (55 gal.)	
83 gallon overpack	X10903	483	7/14/98	525	658	736	yes	D92870 (55 gal.)	
83 gallon overpack	X10904	483	8/3/98	486	661	739	yes	D93469 (55 gal.)	
83 gallon overpack	X10905	483	8/3/98	350	492	570	yes	D93466 (55 gal.)	
83 gallon overpack	X10906	483	8/3/98	223	544	622	yes	D93471 (55 gal.)	DU puck inerted with soil
83 gallon overpack	X10907	483	7/30/98	463	595	673	yes	D93461 (55 gal.)	
83 gallon overpack	X10908	483	7/22/98	343	544	622	yes	D93462 (55 gal.)	
83 gallon overpack	X10909	483	7/13/98	308	582	660	yes	D92863 (55 gal.)	not intact
83 gallon overpack	X10911	483	7/16/98	377	502	580	yes	D93269 (55 gal.)	
83 gallon overpack	X10912	483	7/16/98	340	580	658	yes	D93262 (55 gal.)	
83 gallon overpack	X10913	483	7/16/98	342	491	569	yes	D92852 (55 gal.)	
83 gallon overpack	X10914	483	7/16/98	320	586	664	yes	D93264 (55 gal.)	
83 gallon overpack	X10915	483	7/13/98	585	733	811	yes	D92854 (55 gal.)	
83 gallon overpack	X10916	483	7/8/98	426	557	635	yes	D88407 (55 gal.)	
83 gallon overpack	X10917	483	7/8/98	290	536	614	yes	D88388 (55 gal.)	DU and Mineral Oil, 1.0 ppm PCB, Li Tic's
83 gallon overpack	X10918	483	7/8/98	390	610	688	yes	D88387 (55 gal.)	DU and Mineral Oil, 6.2 ppm PCB

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Container Type	WEM's No.	IDC	Fill (set-up) Date	weight (lbs) prior to inerting	weight (lbs) after inerting	Final Shipping Weight (lbs)	Traveler	Overpack Container No.	Notes
83 gallon overpack	X10919	483	7/8/98	622	490	568	yes	D87699 (55 gal.)	DU and Mineral Oil
83 gallon overpack	X10920	483	7/9/98	366	511	589	yes	D92857 (55 gal.)	
83 gallon overpack	X10921	483	7/9/98	427	557	635	yes	D88406 (55 gal.)	
83 gallon overpack	X10922	483	7/9/98	335	448	526	yes	D92858 (55 gal.)	
83 gallon overpack	X10923	483	7/9/98	355	484	562	yes	D92864 (55 gal.)	
83 gallon overpack	X10924	483	7/8/98	344	642	720	yes	D88413 (55 gal.)	
83 gallon overpack	X10925	483	7/13/98	344	603	681	yes	D92862 (55 gal.)	
83 gallon overpack	X10926	483	7/14/98	318	570	648	yes	D92855 (55 gal.)	
83 gallon overpack	X10927	483	7/8/98	352	614	692	yes	D88415 (55 gal.)	
83 gallon overpack	X10928	483	7/14/98	648	648	726	yes	D92853 (55 gal.)	
83 gallon overpack	X10929	483	7/9/98	369	481	559	yes	D92860 (55 gal.)	
83 gallon overpack	X10930	483	7/9/98	365	509	587	yes	D92869 (55 gal.)	
83 gallon overpack	X10931	483	7/8/98	431	568	646	yes	D88414 (55 gal.)	
83 gallon overpack	X10932	483	7/9/98	396	529	607	yes	D92859 (55 gal.)	
83 gallon overpack	X10933	483	7/9/98	323	613	691	yes	D88419 (55 gal.)	
83 gallon overpack	X10934	483	7/8/98	496	609	687	yes	D88417 (55 gal.)	
83 gallon overpack	X10935	483	7/8/98	338	603	681	yes	D88425 (55 gal.)	
83 gallon overpack	X13255	325	3/8/99		284	362	yes	D93473 (55 gal)	sample returns
83 gallon overpack	X13256	325	03/10/99		10/20/00	372	yes	D93476 (55 gal)	UH3 sample returns
83 gallon overpack	X13257	325	2/16/99		402	480	yes	D93468 (55 gal)	UH3 sample returns
83 gallon overpack	X13258	325	7/6/98		634	712	yes	D87713 (55 gal)	original sample return drum

TRENCH 1 WASTE CONTAINERS

Container Type	WEM's No.	IDC	Fill (set-up) Date	weight (lbs) prior to inerting	weight (lbs) after inerting	Final Shipping Weight (lbs)	estimated volume mineral oil (liters)	estimated quantity of DU (lbs)	Traveler	Overpack Container No.	Notes
110 gallon overpack	X10057	483	07/06/98	347	426	528	38	209	yes	X09851 (83 gal.)	
110 gallon overpack	X10058	483	06/30/98	1092	1558	1660	244	954	yes	SPECIAL	will require further overpacking, excavated 55 gal. drum in 110 gal., weight is with pallet
110 gallon overpack	X10059	483	07/28/98	483	638	740	78	345	yes	X10371 (85 gal.)	
110 gallon overpack	X10060	483	07/01/98	260	370	472	54	122	yes	X09882 (83 gal.)	
110 gallon overpack	X10061	483	07/06/98	?	370	472	#VALUE!	#VALUE!	yes	X09863 (83 gal.)	
110 gallon overpack	X10062	483	07/06/98	254	372	474	59	116	yes	X09864 (83 gal.)	
110 gallon overpack	X10063	823	08/14/98	708	711	813	N/A	N/A	yes	X10399 (85 gal.)	cemented cyanide
110 gallon overpack	X10064	483	07/28/98	567	955	1057	203	429	yes	X10374 (85 gal.)	
110 gallon overpack	X10065	483	07/01/98	282	375	477	45	144	yes	X09854 (83 gal.)	
110 gallon overpack	X10066	823	08/12/98	758	758	860	N/A	N/A	yes	X10397 (85 gal.)	cemented cyanide
110 gallon overpack	X10067	483	07/01/98	333	486	588	77	195	yes	X09888 (83 gal.)	
110 gallon overpack	X10068	483	07/06/98	?	465	567	#VALUE!	#VALUE!	yes	X09875 (83 gal.)	
110 gallon overpack	X10069	483	07/07/98	375	585	687	108	237	yes	X09890 (83 gal.)	
110 gallon overpack	X10070	483	06/30/98	482	726	828	126	344	yes	X09883 (83 gal.)	
110 gallon overpack	X10071	483	07/01/98	271	573	675	157	133	yes	X09857 (83 gal.)	
110 gallon overpack	X10072	483	07/07/98	448	714	816	138	310	yes	X09839 (83 gal.)	
110 gallon overpack	X10073	483	06/30/98	632	851	953	112	494	yes	X09878 (83 gal.)	contained black filters
110 gallon overpack	X10074	483	06/29/98	688	994	1096	159	550	yes	X09874 (83 gal.)	75% intact
110 gallon overpack	X10075	483	07/07/98	523	654	756	66	385	yes	X09842 (83 gal.)	
110 gallon overpack	X10076	483	07/01/98	255	386	488	66	117	yes	X09881 (83 gal.)	
110 gallon overpack	X10077	483	07/01/98	381	480	582	49	243	yes	X09886 (83 gal.)	
110 gallon overpack	X10078	483	07/07/98	381	561	663	92	243	yes	X09856 (83 gal.)	
110 gallon overpack	X10079	483	07/06/98	595	609	711	3	457	yes	X09893 (83 gal.)	included screens
110 gallon overpack	X10080	483	07/01/98	522	800	902	144	384	yes	X09855 (83 gal.)	
110 gallon overpack	X10081	483	07/01/98	338	507	609	86	200	yes	X09885 (83 gal.)	
110 gallon overpack	X11049	483	08/03/98	593	930	1032	175	455	yes	X10398 (85 gal.)	
110 gallon overpack	X11050	483	08/04/98	718	866	968	75	580	yes	X10375 (85 gal.)	
110 gallon overpack	X11051	483	08/12/98	1074	1197	1299	61	936	yes	X10372 (85 gal.)	
110 gallon overpack	X11055	483	06/24/98	840	1096	1198	132	702	yes	X09841 (83 gal.)	
110 gallon overpack	X11056	483	06/30/98	696	1010	1112	163	558	yes	X09884 (83 gal.)	
110 gallon overpack	X11057	483	06/25/98	471	702	804	119	333	yes	X09866 (83 gal.)	
110 gallon overpack	X11058	483	06/22/98	747	977	1079	118	609	yes	X09872 (83 gal.)	contains 55 gal. drum w/ ice cream cartons, weight is with drum grabber

110 GALLON OVERPACK

TRENCH 1 WASTE CONTAINERS

Container Type	WEM's No.	IDC	Fill (set-up) Date	weight (lbs) prior to inerting	weight (lbs) after inerting	Final Shipping Weight (lbs)	estimated volume mineral oil (liters)	estimated quantity of DU (lbs)	Traveler	Overpack Container No.	Notes
110 gallon overpack	X11059	483	06/23/98	764	1004	1106	124	626	yes	X09868 (83 gal.)	
110 gallon overpack	X11060	483	06/25/98	407	580	682	88	269	yes	X09844 (83 gal.)	
110 gallon overpack	X11061	483	06/23/98	470	683	785	109	332	yes	X09865 (83 gal.)	
110 gallon overpack	X11062	483	06/30/98	949	1280	1382	172	811	yes	X09862 (83 gal.)	
110 gallon overpack	X11063	483	07/01/98	754	1099	1201	180	616	yes	X09887 (83 gal.)	
110 gallon overpack	X11064	483	06/17/98	?	910	1012	#VALUE!	#VALUE!	yes	X09837 (83 gal.)	150 liters of mineral oil reported, non-intact
110 gallon overpack	X11065	483	06/25/98	530	655	757	62	392	yes	X09880 (83 gal.)	
110 gallon overpack	X11066	483	06/22/98	618	919	1021	156	480	yes	X09867 (83 gal.)	
110 gallon overpack	X11067	483	06/24/98	?	395	497	#VALUE!	#VALUE!	yes	X09852 (83 gal.)	non-intact
110 gallon overpack	X11068	483	06/25/98	458	704	806	127	320	yes	X09870 (83 gal.)	
110 gallon overpack	X11069	483	06/24/98	795	1078	1180	147	657	yes	X09869 (83 gal.)	sand added due to temperature increase
110 gallon overpack	X11070	483	06/18/98	541	808	910	138	403	yes	X09843 (83 gal.)	
110 gallon overpack	X11071	483	06/25/98	542	761	863	112	404	yes	X09894 (83 gal.)	
110 gallon overpack	X11072	483	06/25/98	609	857	959	128	471	yes	X09871 (83 gal.)	drum smashed
110 gallon overpack	X11073	823	08/14/98	737	740	842	N/A	N/A	yes	X10393 (85 gal.)	cemented cyanide
110 gallon overpack	X11074	823	08/14/98	652	659	761	N/A	N/A	yes	X10382 (85 gal.)	cemented cyanide
110 gallon overpack	X11075	823	08/14/98	695	699	801	N/A	N/A	yes	X10388 (85 gal.)	cemented cyanide
110 gallon overpack	X11076	483	06/18/98	612	845	947	120	474	yes	X09850 (83 gal.)	
110 gallon overpack	X11077	483	06/24/98	542	785	887	125	404	yes	X09877 (83 gal.)	
110 gallon overpack	X11078	483	06/17/98	?	870	972	#VALUE!	#VALUE!	yes	X09838 (83 gal.)	350 liters mineral oil reported
110 gallon overpack	X11079	483	06/16/98	516	575	677	27	378	yes	X09835 (83 gal.)	drum partially crushed, inerted with sand
110 gallon overpack	X11080	483	07/01/98	899	1207	1309	160	761	yes	X09876 (83 gal.)	
110 gallon overpack	X11081	823	08/14/98	631	633	735	N/A	N/A	yes	X10390 (85 gal.)	cemented cyanide
110 gallon overpack	X11083	823	08/14/98	751	767	869	N/A	N/A	yes	X10376 (85 gal.)	cemented cyanide
110 gallon overpack	X11084	823	08/14/98	747	754	856	N/A	N/A	yes	X10377 (85 gal.)	cemented cyanide
110 gallon overpack	X11085	823	08/12/98	697	707	809	N/A	N/A	yes	X10401 (85 gal.)	cemented cyanide
110 gallon overpack	X11087	483	06/17/98	?	943	1045	#VALUE!	#VALUE!	yes	X09840 (83 gal.)	155 liters mineral oil reported
110 gallon overpack	x11092	823								x10373 (85 gal.)	

TRENCH 1 WASTE CONTAINERS

Container Type	WEM's No.	IDC	Fill (set-up) Date	Final Shipping Weight (lbs)	In Storage Area	Traveler	Overpack Container No.	Notes
B-12 Metal Box	X09794	861	09/25/98	?	yes	yes	N/A	weight needed before "Dock Inspection" can be completed, 100 gal drum????
B-12 Metal Box	X09795	326	09/30/98	1694	no	yes	N/A	IN PROCESS IN TENT (weight needed before "Dock Inspection" can be completed
B-12 Metal Box	X09796	326	09/25/98	890	yes	yes	N/A	weight needed before "Dock Inspection" can be completed
B-12 Metal Box	X09797							
B-12 Metal Box	X09798	374	08/18/98	3758	yes	yes	N/A	"Dock Inspection" needs to be completed
B-12 Metal Box	X09799	374	08/19/98	3874	yes	yes	N/A	"Dock Inspection" needs to be completed
B-12 Metal Box	X09800	374	08/18/98	4024	yes	yes	N/A	"Dock Inspection" needs to be completed
B-12 Metal Box	X09801	374	08/18/98	3906	yes	yes	N/A	"Dock Inspection" needs to be completed
B-12 Metal Box	X09803	374	08/19/98	4392	yes	yes	N/A	LLW "Dock Inspection" needs to be completed
B-12 Metal Box	X09804	374	08/19/98	3994	yes	yes	N/A	"Dock Inspection" needs to be completed
B-12 Metal Box	X09805	374	08/14/98	3572	yes	yes	N/A	"Dock Inspection" needs to be completed
B-12 Metal Box	X09806	374	07/29/98	5092	yes	yes	N/A	"Dock Inspection" needs to be completed
B-12 Metal Box	X09807	374	07/07/98	4154	yes	yes	N/A	"Dock Inspection" needs to be completed
B-12 Metal Box	X09808	374	06/30/98	4374	yes	yes	N/A	"Dock Inspection" needs to be completed
B-12 Metal Box	X09809	374	08/17/98	4088	yes	yes	N/A	"Dock Inspection" needs to be completed
B-12 Metal Box	X09810	374	08/14/98	4342	yes	yes	N/A	"Dock Inspection" needs to be completed
B-12 Metal Box	X09821	374	08/17/98	3866	yes	yes	N/A	"Dock Inspection" needs to be completed
B-12 Metal Box	X09822	374	08/17/98	4088	yes	yes	N/A	"Dock Inspection" needs to be completed
B-12 Metal Box	X09823	374	06/25/98	4222	yes	yes	N/A	"Dock Inspection" needs to be completed
B-12 Metal Box	X09824	374	06/22/98	5090	yes	yes	N/A	"Dock Inspection" needs to be completed
B-12 Metal Box	X09825	374	06/19/98	5514	yes	yes	N/A	torque done by Lonnie & Pepping "Dock Inspection needs to be completed
B-12 Metal Box	X09826	374	07/06/98	3936	yes	yes	N/A	"Dock Inspection" needs to be completed
B-12 Metal Box	X09827	374	06/23/98	4404	yes	yes	N/A	"Dock Inspection" needs to be completed
B-12 Metal Box	X09828	374	06/24/98	4624	yes	yes	N/A	"Dock Inspection" needs to be completed
B-12 Metal Box	X09829	374	08/05/98	4850	yes	yes	N/A	contains soil & a 5 gal. metal container w/ potential sample jars "Dock Inspection" needs to be completed
B-12 Metal Box	X09830	374	06/15/98	2168 kg	yes	yes	N/A	hold for inerting soil "Dock Inspection" needs to be completed
B-12 Metal Box	X09831	374	6/16/98	5238	yes	yes	N/A	torque done by Lonnie & Pepping "Dock Inspection needs to be completed
B-12 Metal Box	X09832	326	09/15/98	1120	yes	yes	N/A	"Dock Inspection" needs to be completed
B-12 Metal Box	X09833	374	08/04/98	4260	yes	yes	N/A	"Dock Inspection" needs to be completed
B-12 Metal Box	X09834	374	08/04/98	4762	yes	yes	N/A	"Dock Inspection" needs to be completed

TENCH 1 WASTE CONTAINERS

Container Type	WEM's No.	IDC	Fill (set-up) Date	Final Shipping Weight (lbs)	In Storage Area	Traveler	Overpack Container No.	Notes
~~B-88 Metal Box~~	~~X09695~~	~~861~~	~~09/24/98~~		~~yes~~	~~yes~~	~~N/A~~	shipped to NTS 2/3/99
~~B-88 Metal Box~~	~~X09696~~	~~861~~	~~09/24/98~~		~~yes~~	~~yes~~	~~N/A~~	shipped to NTS 2/3/99
~~B-88 Metal Box~~	~~X09697~~	~~861~~	~~09/24/98~~		~~yes~~	~~yes~~	~~N/A~~	shipped to NTS 2/3/99
B-88 Metal Box	X09698	374	08/26/98	9028	yes	yes	N/A	
B-88 Metal Box	X09699	374	08/26/98	9410	yes	yes	N/A	
B-88 Metal Box	X09700	374	08/26/98	9658	yes	yes	N/A	
B-88 Metal Box	X09701	326	08/26/98	6466	yes	yes	N/A	
B-88 Metal Box	X09702	374	08/26/98	9690	yes	yes	N/A	
B-88 Metal Box	X09703	374	08/26/98	9308	yes	yes	N/A	
B-88 Metal Box	X09704	374	08/26/98	9486	yes	yes	N/A	
B-88 Metal Box	X09705	374	08/26/98	9352	yes	yes	N/A	
B-88 Metal Box	X09706	374	08/26/98	9812	yes	yes	N/A	
B-88 Metal Box	X09707	374	08/26/98	9110	yes	yes	N/A	
B-88 Metal Box	X09708	374	08/26/98	9482	yes	yes	N/A	
B-88 Metal Box	X09709	374	08/26/98	8784	yes	yes	N/A	
B-88 Metal Box	X09710	374	08/26/98	9666	yes	yes	N/A	
B-88 Metal Box	X09711	374	08/26/98	9396	yes	yes	N/A	
B-88 Metal Box	X09712	374	08/20/98	8512	yes	yes	N/A	
B-88 Metal Box	X09713	374	08/19/98	9592	yes	yes	N/A	
B-88 Metal Box	X09714	374	08/19/98	8972	yes	yes	N/A	
B-88 Metal Box	X09715	374	08/20/98	9026	yes	yes	N/A	
B-88 Metal Box	X09716	374	08/20/98	9472	yes	yes	N/A	
B-88 Metal Box	X09717	374	08/20/98	8796	yes	yes	N/A	
B-88 Metal Box	X09718	374	08/26/98	8894	yes	yes	N/A	
B-88 Metal Box	X09719	374	08/26/98	9058	yes	yes	N/A	
B-88 Metal Box	X09720	374	08/26/98	9618	yes	yes	N/A	
B-88 Metal Box	X09721	374	08/26/98	8962	yes	yes	N/A	
B-88 Metal Box	X09722	374	08/26/98	9218	yes	yes	N/A	
B-88 Metal Box	X09723	374	08/26/98	9226	yes	yes	N/A	
B-88 Metal Box	X09724	374	08/26/98	9108	yes	yes	N/A	
B-88 Metal Box	X09725	374	08/26/98	9178	yes	yes	N/A	>5k <10k
B-88 Metal Box	X09726	325	07/15/98	3602	yes	yes	N/A	
B-88 Metal Box	X09727	374	08/17/98	9104	yes	yes	N/A	

B-88 METAL BOX

TENCH 1 WASTE CONTAINERS

Container Type	WEM's No.	IDC	Fill (set-up) Date	Final Shipping Weight (lbs)	In Storage Area	Traveler	Overpack Container No.	Notes
B-88 Metal Box	X09728	374	07/14/98	9678	yes	yes	N/A	
B-88 Metal Box	X09729	374	08/11/98	9636	yes	yes	N/A	LLW - soil
B-88 Metal Box	X09730	374	08/19/98	9226	yes	yes	N/A	LLW
B-88 Metal Box	X09731	374	07/29/98	8902	yes	yes	N/A	LLW
B-88 Metal Box	X09732	374	07/29/98	9446	yes	yes	N/A	
B-88 Metal Box	X09733	326	07/14/98	1706	yes	yes	N/A	
B-88 Metal Box	X09734	374	08/19/98	9536	yes	yes	N/A	
B-88 Metal Box	X09735	374	08/19/98	9672	yes	yes	N/A	LLM
B-88 Metal Box	X09736	326	07/06/98	2226	yes	yes	N/A	
B-88 Metal Box	X09737	374	07/06/98	9372	yes	yes	N/A	
B-88 Metal Box	X09738	374	07/07/98	9494	yes	yes	N/A	
B-88 Metal Box	X09739	374	07/07/98	9562	yes	yes	N/A	
B-88 Metal Box	X09740	326	09/08/98	1420	yes	yes	N/A	
B-88 Metal Box	X09741	374	06/29/98	9660	yes	yes	N/A	
B-88 Metal Box	X09742	374	06/23/98	9632	yes	yes	N/A	
B-88 Metal Box	X09743	374	06/30/98	9140	yes	yes	N/A	
B-88 Metal Box	X09744	374	06/30/98	9150	yes	yes	N/A	
B-88 Metal Box	X09745	374	06/29/98	9144	yes	yes	N/A	
B-88 Metal Box	X09746	374	06/29/98	8620	yes	yes	N/A	
B-88 Metal Box	X09747	374	06/29/98	9672	yes	yes	N/A	
B-88 Metal Box	X09748	374	06/29/98	9302	yes	yes	N/A	
B-88 Metal Box	X09749	374	07/01/98	9222	yes	yes	N/A	
B-88 Metal Box	X09750	374	06/29/98	9794	yes	yes	N/A	
B-88 Metal Box	X09751	374	06/24/98	9976	yes	yes	N/A	
B-88 Metal Box	X09752	374	06/22/98	9148	yes	yes	N/A	
B-88 Metal Box	X09753	374	06/25/98	9702	yes	yes	N/A	
B-88 Metal Box	X09754	374	06/25/98	9662	yes	yes	N/A	
B-88 Metal Box	X09755	374	06/29/98	8818	yes	yes	N/A	
B-88 Metal Box	X09756	374	06/29/98	9228	yes	yes	N/A	
B-88 Metal Box	X09757	374	06/22/98	9018	yes	yes	N/A	
B-88 Metal Box	X09758	374	06/24/98	8674	yes	yes	N/A	
B-88 Metal Box	X09759	374	06/23/98	9960	yes	yes	N/A	
B-88 Metal Box	X09760	326	07/06/98	2214	yes	yes	N/A	

TENCH 1 WASTE CONTAINERS

Container Type	WEM's No.	IDC	Fill (set-up) Date	Final Shipping Weight (lbs)	In Storage Area	Traveler	Overpack Container No.	Notes
B-88 Metal Box	X09761	374	06/18/98	9850	yes	yes	N/A	
B-88 Metal Box	X09762	374	06/16/98	8430	yes	yes	N/A	
B-88 Metal Box	X09763	374	06/12/98	8340	yes	yes	N/A	
B-88 Metal Box	X09764	374	06/16/98	9586	yes	yes	N/A	
~~B-88 Metal Box~~	~~X11519~~	~~861~~	~~09/24/98~~		~~yes~~	~~yes~~	~~N/A~~	shipped to NTS 2/3/99
~~B-88 Metal Box~~	~~X11520~~	~~861~~	~~09/24/98~~		~~yes~~	~~yes~~	~~N/A~~	shipped to NTS 2/3/99

Appendix D-2
T-1 Depleted Uranium Gamma Spectroscopy Data, Descriptions of Samples and Radioactive Material Type Determination Spreadsheet

T-1 Gamma Spectroscopy Data and Summary Information

mple #	Inner Drum #	QC Type	Collection Date	Event_Comment	All gamma spectrocopy results in pCi/g AC-228 Result	Detection	AM-241 Result	Detection	TH-234 Result	Detection	U-235 Result	Detection	PA-234M Result	Detection	Calculated U mass ratio %(U-235/U-238)	Calculated Uranium Type DU/EU/Natural
2105-001	X09832	REAL	6/12/98	SOURCE REMOVAL DEPLETED URANIUM IN WEMS # X09832, FIVE LOCATIONS WITHIN B12 FIELD SCREENED, HIGH BETA IN ONE LOCATION, HIGH BETA LOCATION SAMPLED, MIXED SOIL AND DU, MAINLY SOIL	0	2.4246	0	21.316	9310.2	50.841	102.63	2.3179	9770.1	85.906	0.16	depleted
2105-003	X09830	REAL	6/15/98	SOURCE REMOVAL DEPLETED URANIUM IN WEMS# X9830,FIELD SCREEN 5 LOCATIONS, SAMPLED 2 HOT SPOTS, BIASED FOR BLACK MATERIAL	0.95959	0.7915	0	10.619	1908.8	22.172	23.92	1.5201	1695.2	37.583	0.22	depleted
2105-005	X09835	REAL	6/15/98	30 GAL DU DRUM IN 83-GAL OVERPACK. DRUM HAD 10-15 GAL OF FINE BLACK POWDER. INERTED DRUM W/ SAND AT TRENCH. REMOVED SAND FOR SAMPLE-MOSTLY PURE BLACK POWDER FROM WITHIN DRUM, POWDER EXHIBITED WHITE SMOKE-MAY BE PYROPHORIC.	0	9.47	0	468.46	220000	1321.8	2627.5	81.332	204690	188.86	0.20	depleted
2105-006	X09850	REAL	6/17/98	BLACK PASTE LIKE DU IN RUSTED 30 GAL OVERPACKED INTO NEW 83 GAL. ADDED ABOUT 36 L MINERAL OIL TO INERT. 100 PPM VOC ON PID, 1000 PPM ON PID, DRUM PUNCTURED TWICE.	0	14.885	0	811.2	163600	1473.7	1675.4	86.204	183450	289.86	0.14	depleted
2105-007	X09837	REAL	6/17/98	DU IN RUSTED 33 GAL IN RUSTED 55 GAL OVERPACKED INTO A NEW 83 GAL. SOME LIQUID (ASSUMED WATER) SPILLED IN TRENCH. BRACED AND INERTED W/ MINERAL OIL IN 83 GAL OVERPACK. DU HIGHLY OXIDIZED YELLOW-YELLOW GREEN, SHADES OF RED, MOIST,STICKY. FROM UPPER 6 IN	0	13.956	0	682.06	154640	1242.5	1313.5	60.988	130790	275.63	0.16	depleted
105-009	X09840	REAL	6/17/98	DU DRY BLACK POWDER IN RUSTED 30GAL OVERPACKED INTO A NEW 83 GAL. ADDED 155 L OF MINERAL OIL. ADDED DTA,TGA,VOA,XRD,XRF,IR,ISO-PU,AM & GAMMA SPEC FOR CHARACTERIZATION	0	18.994	0	1083.6	233700	3049.8	2588	175.8	216370	376.26	0.19	depleted
105-010	X09838	REAL	6/17/98	DU WET BLACK POWDER WITH VISIBLE TURNINGS AND 3-IN GREEN OBJECT IN RUSTED 30GAL OVERPACKED INTO A NEW 83 GAL. ADDED ABOUT 150 L OF MINERAL OIL. ADDED DTA,TGA,VOA,XRD,XRF,IR,ISO-PU,AM FOR CHARACTERIZATION	0	15.153	308.47	274.41	93244	1256.3	1117.5	60.42	139540	288.12	0.12	depleted
105-011	X09831	REAL	6/18/98	DU END OF B-12. SMALL YELLOW/GREEN DU AND FILINGS,600 PPM TVA,1000 PPM PID	0	15.545	0	759.67	223945	2090.9	2127.2	101.96	180975	296.88	0.18	depleted
105-013	X09843	REAL	6/18/98	DU DRUM 3/4 FULL OF MOIST BLACK POWDER INSPECTED TOP 6 IN. COATING OF YELLOW/GREEN OXIDE 1/4 INDEEP.LATHE TURNINGS IN BLACK POWDER, SOME SHINY CUTTINGS. OTHER FRAGMEMTS SPLINTERY GUN BARREL BLUE TO BLACK TO RUSTY. INERTED W/ MINERAL OIL VOC 1800 PPM PID	0	16.509	0	861.94	170080	1620.3	1356.8	117.5	177990	328.22	0.12	depleted
105-014	X09825	REAL	6/19/98	DU BLACK,YELLOW,GREEN AND ORANGE OXIDES FROM NON INTACT DRUMS.SLUDGE LIKE MATERIAL MIXED WITH DIRT. PACKED INTO NEW B-12 SAMPLES FROM 2 DRUMS IN B-12. ONE MOIST CLAY LIKE, OTHER GREEN AND YELLOW DRIER. TVA 1000 PPM, PID 1,500 PPM, FID 3,000 PPM.	0	15.017	0	746.94	146100	1384.4	1399.5	79.845	167260	306.07	0.13	depleted
105-015	X09872	REAL	6/22/98	BLACK OXIDE, SLIGHTLY WET AND COHESIVE. TVA 1000, PID 1100.	0	4.0161	357.94	50.009	28545	115.52	332.2	6.9232	28557	73.981	0.18	depleted

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T-1 Gamma Spectroscopy Data and Summary Information

mple #	Inner Drum #	QC Type	Collection Date	Event_Comment	AC-228 Result	AC-228 Detection	AM-241 Result	AM-241 Detection	TH-234 Result	TH-234 Detection	U-235 Result	U-235 Detection	PA-234M Result	PA-234M Detection	Calculated U mass ratio %(U-235/U-238)	Calculated Uranium Type DU/EU/Natural
				All gamma spectrocopy results in pCi/g												
A2105-016	X09824	REAL	6/22/98	SAMPLED FROM 2 DRUMS; 1 WITH BLACK OXIDIZED POWDER, THE OTHER WITH GREENISH BLACK SOLIDS. SAMPLE WAS COLLECTED AS B-12 WAS FILLED BY USING A ZIPLOC BAG, THEN FILLING SAMPLE JARS FROM THE BAG. TVA-1000, PID-120.	0	15.68	0	963.27	185130	1554.4	1575.2	132.09	186030	307.68	0.13	depleted
A2105-017	X09867	REAL	6/22/98	DRUM APPROX. 90% FULL, BLACK POWDER, SLIGHTLY DAMP, SLIGHTLY COHESIVE. FID-7000, TVA-1000.	0	17.496	0	1053.5	207290	1763.3	1403.3	114.14	209090	355.48	0.10	depleted
A2105-019	X09868	REAL	6/23/98	DU BLACK GRANULAR MATERIALS WITH TURNINGS, DRUM ABOUT 2/3 FULL SLIGHTLY DAMP	0	25.462	0	1796.5	322070	2975.2	2331	185.59	325050	484.21	0.11	depleted
A2105-020	X09865	REAL	6/23/98	DU SATURATED BALCK MATERIAL, WET LIKE MUD, DRUM ABOUT 1/2 FULL.	0	15.535	0	846.27	172320	1404.7	1474.8	85.588	172300	305.7	0.13	depleted
2105-021	X09827	REAL	6/23/98	DU METAL TURNINGS AND CUTTINGS, SPRINGY, GREENISH YELLOWISH, LONG AND THIN, CURLY. SAMPLED COMPOSITE OF THREE TYPES OF MATERIAL, FINE CUTTINGS/COARSE CUTTINGS/ AND GREEN/YELLOW W/ SOLIDS. BOTTLES HAVE MANY VOID SPACES. SHEARS COUND NOT CUT MATERIAL	0	23.247	0	1141.4	222210	1947.4	1768.3	116.57	221700	504.69	0.12	depleted
2105-022	X09877	REAL	6/24/98	DU DAMP COHESIVE GEENISH BLACK CONTENTS	0	14.782	0	772.21	163550	1258.5	1139.9	74.195	162580	291.75	0.11	depleted
2105-023	X09852	REAL	6/24/98	DU SOIL TANNISH/BROWN,RUSTY, FILAMENT LIKE CONTENT W/ GREENISH COHESIVE CHUNKS. VERY LITTLE MATERIAL IN DRUM, SO DIFFICULT TO COLLECT REPRESENTATIVE SAMPL, DUPLICATES MAY NOT COMPARE WELL	19709	53.088	0	294.345	0	2549.5	0	56.407	0	1360.6	N.A.	Thorium Waste
2105-024	X09852	DUP	6/24/98	SEE 98A2105-023	18348	49.711	0	275.54	0	2310.1	0	53.45	0	1298.7	N.A.	Thorium Waste
2105-026	X09828	REAL	6/24/98	DU METAL TURNINGS, GREENISH YELLWOISH GANUALAR MATERIAL. SAMPLED FROM 4 AREAS FROM B-12. THREE AREAS YELLOW/GREEN MATERIAL OTHER AREAS INTACT TURNINGS.	0	18.737	0	960.97	198780	1688.1	1215.3	121.05	197020	384.94	0.10	depleted
2105-027	X09841	REAL	6/24/98	DU INTANCT DRUM ABOUT 85% FULL OF CONSOLIDATED GREENISH MATERIAL. VERY HARD, SAMPLED BY SCRAPING SURFACE.	0	20.027	0	1224.7	238660	2167.9	1780.9	105.17	237490	373.57	0.12	depleted
2105-028	X09869	REAL	6/24/98	DU DRUM INTO 83 OVERPACK, SHOWED HEAT RISE INERTED WITH 2 GALLONS SAND AND MINERAL OIL BEFORE SAMPLING. DRY STICKY BLACK POWDER, LIKE PHOTCOPIER TONER	0	17.313	0	1161.8	219530	1990	1741.2	110.64	216010	339.53	0.13	depleted
2105-029	X09870	REAL	6/25/98	BLACK POWDER SLIGHTLY DAMP DRUM ABOUT HALF FULL PLACE IN 83-GAL OVERPACK	0	15.201	0	783.26	165350	1325.8	1098	75.566	161730	297.51	0.11	depleted
105-030	X09894	REAL	6/25/98	DU FROM DRUM SLIGHTLY DAMP BLACK POWDER, OVERPACKED INTO 83 GAL	0	18.457	0	1045	210260	1846	1580.2	113.14	211290	363.59	0.12	depleted
105-034	X09871	REAL	6/25/98	DU DRUM DAMAGED ABOUT 1/3 FULL. DU BLACKENED METAL CHIPS, COUSE GRANUALR, DRY WITH SMALL AMOUNT OF GREENISH MATERIAL.	0	25.149	0	1906	318040	5693.7	2748.7	225.32	330940	479.21	0.13	depleted
105-035	X09866	REA	6/25/98	DU BLACKISH, DAMP, COHESIVE, DISTINCT CHIPS AND TURNINGS, INTO 83-GAL OVERPACK	0	11.423	0	412.55	63715	747.46	715.2	36.496	63698	351.03	0.17	depleted

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T-1 Gamma Spectroscopy Data and Summary Information

mple #	Inner Drum #	QC Type	Collection Date	Event_Comment	All gamma spectrocopy results in pCi/g AC-228 Result	Detection	AM-241 Result	Detection	TH-234 Result	Detection	U-235 Result	Detection	PA-234M Result	Detection	Calculated U mass ratio %(U-235/U-238)	Calculated Uranium Type DU/EU/Natural
2105-036	X09845	REAL	6/25/98	DU DRUM 90% FULL OF GREEN/YELLOW MATERIAL. WITH CARDBOARD 5 GAL ICE CREAM CONTAINERS. SAMPLED FROM 5 CONTAINERS ON TOP LAYER CUTTING OF DARK GREEN OR BLACK COLOR WITH LIGHT GREEN POWDERY MATERIAL. CARDBOARD DRY.	0	16.813	0	1141.9	184420	1936.2	1223.7	129.44	226480	337.62	0.08	depleted
2105-037	X09844	REAL	6/25/98	DU BLACK PASTY MATERIAL BUT NO FREE LIQUID PRESENT. LIMITED GREENISH MATERIAL, DRUM 1/3 FULL INTO NEW 83 GALL OVERPACK	0	14.371	0	808.51	169750	1435.2	1951.5	79.756	169010	278.27	0.18	depleted
2105-038	X09880	REAL	6/25/98	DU GREENISH FINE MATERIAL AND CHIPS AND TURNINGS, DRY, 30 GAL INTO NEW 83 GAL OVERPACK	0	18.139	0	953.455	196015	2822.6	1296.6	103.142	198725	362.135	0.10	depleted
2105-040	X09823	REAL	6/25/98	SAMPLED FROM B-12, TWO TYPES OF MATERIAL: GREEN ROCKY AND BROWN PASTY MATERIAL WITH VISIBLE TURNINGS, BROWN FROM END OF BOX, HARD GREEN MATREAIL WAS THROUGHOUT BOX.	4107.1	21.535	0	809.86	62864	1454.4	353.24	95.416	59893	378.64	0.09	DU + Thorium
2105-041	X09874	REAL	6/29/98	30 GAL DU DRUM OVERPACKED INTO NEW 83-GAL OVERPACK, 30 GAL DRUM ABOUT 1/2 FULL, DRY GRANUALR YELLOWISH/GREENISH MATERIAL COHESIVE	0	18.786	0	1162.2	223110	1971.1	1708.3	112.45	222390	371.23	0.12	depleted
2105-042	X09860	REAL	6/30/98	DU in 30/55 overpacked into new 83 gal, 30 gal about 60% full, dry cohesive material	0	19.586	0	1194.3	235450	2025.1	1824.5	148.88	235150	375.6	0.12	depleted
2105-043	X09862	REAL	6/30/98	DU IN 55 GAL ABOUT 2/3 FULL OF 1 GAL CARDBOARD ICE CREAM CONTAINERS FILLED WITH DRY BALCK DU CHIPS AND TURININGS, DRUM IS YELLOW AND IN GOOD CONDITION	0	23.902	0	1912.6	289250	3165.1	2660.6	319.86	334360	464.17	0.12	depleted
105-044	X09862	DUP	6/30/98	DU IN 55 GAL ABOUT 2/3 FULL OF 1 GAL CARDBOARD ICE CREAM CONTAINERS FILLED WITH DRY BALCK DU CHIPS AND TURININGS. DRUM IS YELLOW AND IN GOOD CONDITION	0	23.721	0	1896.2	293010	3218.1	1238.4	170.98	324570	466.38	0.06	depleted
105-045	X09884	REAL	6/30/98	DU IN 30 GAL/55 GAL 2/3 FULL OF BLACK CHIPS AND TURNINGS, OVERPACKED IN NEW 83 GAL,	0	23.648	0	1897.6	286080	3178.6	2078.4	188.18	328380	462.02	0.10	depleted
105-047	X09878	REAL	6/30/98	DU 55 GAL DRUM 2/3 FULL OF 1 GAL CARDBOARD ICE CREAM CONTAINERS FILLED WITH GREEN FINE GAINED DU WITH SHINY MATERIAL AND FINE MESH SCREEN, DRUM OVERPACKED INTO NEW 83 GAL	0	23.115	0	1023.5	229540	1937.7	2628.7	108.03	271800	437.74	0.15	depleted
105-048	X09883	REAL	6/30/98	DU 30 GAL/55 GAL DRUM 2/3 FULL OF BLACK CHIPS & TURNINGS WITH BROWNISH WITH SPARSE SHINY METAL SPECKS AND CHIPS, DRUM OVERPACKED INTO NEW 83 GAL	0	7.6405	0	175.58	30216	308	530.23	16.586	30757	149.88	0.27	depleted
105-049	X10058	REAL	6/30/98	55 GAL DRUM WITH 1 GAL CARDBOARD ICE CREAM CONTAINERS AND BROWNISH/GRAY DU WITH SOME GREENISH CHIPS, OVERPACKED INTO 110	0	25.172	0	1892.2	319690	7437.7	2470.6	204.92	335010	498.46	0.11	depleted
105-050	X09808	REAL	6/30/98	B-12 WITH YELLOW/GREEN MATERIAL, SAMPLED FROM TWO 5 IN DEEP MASSES IN ONE CORNER, VERY HARD MATERIAL USED NONSPARKING BAR TO LOOSEN MATERIAL TO SAMPLE	0	15.526	0	960.88	193910	1722.9	1455.1	113.03	184880	301.17	0.12	depleted

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T-1 Gamma Spectroscopy Data and Summary Information

	Inner	QC	Collection		All gamma spectrocopy results in pCi/g												Calculated	Calculated
					AC-228		AM-241		TH-234		U-235		PA-234M				U mass ratio	Uranium Type
ple #	Drum #	Type	Date	Event_Comment	Result	Detection	Result	Detection	Result	Detection	Result	Detection	Result	Detection			%(U-235/U-238)	DU/EU/Natural
2105-051	X09853	REAL	6/30/98	55 GAL FULL OF 1 GAL CARDBOARD ICE CREAM CONTAINERS, SAMPLED FROM 4 CONTAINERS ON TOP LAYER, DU BLACK CHIPS WITH TURNINGS, OVERPACKED IN 83 GAL	0	24.212	0	1902.5	289860	3195.6	2121.5	181.48	332380	474.92			0.10	depleted
2105-053	X09855	REAL	7/1/98	DU 30 GAL/55 GAL HAS BLACK TURNINGS AND CHIPS, 30 GAL 1/2 FULL OF TURNINGS, NO SOIL, 55 GAL WELL INTACT, NO CIMCOOL, WITH A FEW SHINY TURNINGS	0	24.415	0	1919.4	310620	3226.8	2545.6	190.78	321940	478.91			0.12	depleted
2105-054	X09879	REAL	6/30/08	55 GAL FULL OF 1 GAL CARDBOARD ICE CREAM CONTAINERS, SAMPLED FROM 8 CONTAINERS ON TOP, BLACKISH/GREENISH/YELLOWISH DRY CHIPS, DRUM OVERPACKED INTO 83 GAL	0	23.93	0	1913.7	316540	3178.3	2581.7	248.11	320430	464.43			0.13	depleted
105-055	X09887	REAL	7/1/98	55 GAL DRUM 2/3 FULL OF CARDBOARD ICE CREAM CONTAINERS, SAMPLED FROM TOP 7 CONTAINERS, DU MOSTLY BLACK TURNINGS AND CHIPS WITH SOME DULL GREEN TURNINGS, OVERPACKED INTO 83 GAL	0	23.694	0	1892.9	302960	3174.3	2151	261.53	314090	462.76			0.11	depleted
105-056	X09882	REAL	7/1/98	55 GAL IN GOOD SHAPE, 1/3 FULL OF ICE CREAM CONTAINERS FALLEN APART (REMOVED FROM DRUM), DU IS GREEN HARD MASSES, ONE BUNCH OF SHINY BLACK TURNINGS, SOME LIQUID IN BOTTOM OF DRUM-NOT PUMPABLE, BLACK/SHINY TURNINGS, SAMPLED FROM 1 CONTAINER. 83 OVERPACK	0	16.839	0	712.71	156380	1208.3	1125.1	72.39	156390	342.87			0.11	depleted
105-057	X09881	REAL	7/1/98	55 GAL WITH ICE CREAM CONTAINERS ABOUT 3/4 FULL. CONTAINERS HAVE SAND PAPER, 5 HAVE BLACK CHIPS AND TURNINGS WHICH WERE SAMPLED, OVERPACKED INTO 83 GAL	0	17.928	0	891.99	143640	1612.6	1263.3	107.39	145830	351.27			0.13	depleted
105-059	X09854	REAL	7/1/98	55 GAL WITH ICE CREAM CONTAINERS. DRUM ABOUT 2/3 FULL OF CONTAINERS, REMOVED CONTAINERS DRUM ABOUT 1/3 FULL	0	13.585	0	371.61	86290	637.66	643.87	34.661	86189	287.16			0.12	depleted
105-060	X09876	REAL	7/1/98	55 GAL WITH ICE CREAM CONTAINERS. DRUM ABOUT 3/4 FULL OF CONTAINERS, CONTAINERS HAVE GREEN AND BLACK DU, SAMPLED 8 CONTAINERS, SOME SHINY MATERIAL PRESENT MOST LIKELY STAINLESS	0	24.316	0	1907.2	305450	3192.5	2213.7	243.78	326880	475			0.11	depleted
105-061	X09857	REAL	7/1/98	55 GAL WITH LID INTACT UNABLE TO REMOVE WHOLE LID, DRUM 2/3 FULL OF ICE CREAM CONTAINERS WITH STAINLESS STEEL TURNINGS ON TOP & GREEN DU ON THE BOTTOM, 83 GAL OVERPACKED	9.0461	13.754	0	699.46	157650	1210.2	1608.7	75.322	156870	361.24			0.16	depleted
105-062	X09886	REAL	7/1/98	55 GAL DRUM WITH ICE CREAM CONTAINERS ABOUT 5/6 FULL, REMOVED CONTAINERS AND DRUM 1/2 FULL, SAMPLED FROM LOWER CONTAINERS ORAGNE-BLACK "PEANUT BUTTER" LIKE MATERIAL	0	14.657	0	776.34	166480	1340.1	1277.7	80.498	168500	301.18			0.12	depleted
105-063	X09888	REAL	7/1/98	55 GAL WITH ICE CREAM CONTAINERS, IN GOOD CONDITION, BOTTOM CONTAINERS BLACK DU CHIPS & TURNINGS, SAMPLED BOTTOM 8 CONTAINERS, 83 GAL OVERPACKED	0	24.396	0	1905.5	311460	3164.05	2308.75	198.175	323330	479			0.11	depleted

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T-1 Gamma Spectroscopy Data and Summary Information

	Inner	QC	Collection		All gamma spectrocopy results in pCi/g										Calculated	Calculated
					AC-228		AM-241		TH-234		U-235		PA-234M		U mass ratio	Uranium Type
...#	Drum #	Type	Date	Event_Comment	Result	Detection	Result	Detection	Result	Detection	Result	Detection	Result	Detection	%(U-235/U-238)	DU/EU/Natural
2105-064	X09888	DUP	7/1/98	55 GAL WITH ICE CREAM CONTAINERS, IN GOOD CONDITION, BOTTOME CONTAINERS BLACK DU CHIPS & TURNINGS, SAMPLED BOTTOM 8 CONTAINERS, 83 GAL OVERPACKED	0	24.133	0	1907.2	306980	3190.6	2235.4	225.87	316830	467.65	0.11	depleted
2105-066	X09885	REAL	7/1/98	30 GAL IN 55 GAL OVERPACKED INTO 83 GAL. 30 GAL ABOUT 1/3 FULL OF BLACK PUMICE LIKE MATERIAL ON TOP, 1" BELOW FINE RED BROWN POWDER. SAMPLED BOTH MATERIALS	0	20.665	0	1359	258760	2358.6	2017.6	158.65	257170	415.4	0.12	depleted
2105-067	X09864	REAL	7/6/98	55 GAL DRUM W/ CARDBOARD ICE CREAM CONTAINERS AND SMALL AMOUNT OF SOIL, FROM ABOUT 1/2 FULL OF CONTAINERS SOME BRIGHT GREEN GRANUALR DU, REMOVED ICE CREAM CONTAINERS W/ SAND PAPER PRIOR TO SAMPLING. SAMPLED FROM THREE CONTAINERS LOOSE DU	0	18.392	0	847.86	179810	1446.3	1407.9	89.292	187000	377.86	0.12	depleted
2105-068	X09863	REAL	7/6/98	55 GAL DRUM FULL TO THE TOP W/ LIQUID, pH=8, PUMPED OFF LIQUID TO BOTTOM, LID LOOSE, DRUM FULL OF ICE CREAM CONTAINERS, REMOVED ICE CREAM CONTAINERS FROM TOP DOWN TO ABOUT 1/3 FULL, SAMPLED FROM BOTTOM CONTAINERS BLACK GRANUALR WET W/ TURNINGS	0	3.1059	0	26.546	2506.4	44.94	20.416	2.7955	2519.9	84.669	0.13	depleted
2105-069	X09851	REAL	7/6/98	55 GAL 2/3 FULL OF ICE CREAM CONTAINERS, SOME SAND PAPER REMOVED, CONTAINERS HAVE GREEN GRANUALER DU AND BLACK FINE MATERIAL W/ NO RAD RESPONSE, SAMPLED GREEN MATERIAL, OVERPACKED INTO 83 GAL	0	15.074	0	748.06	147230	1270.6	1254.1	73.045	145340	287.36	0.13	depleted
105-070	X09826	REAL	7/6/98	SOIL AND PARTIAL DRUM CONTENTS IN B-12, SOME VISIBLE GREEN GRANUALS, DU AT SURFACE. SAMPLED FROM GREEN MATERIAL SOME MAYBE CONCRETED IN BALL.	0	16.214	0	984.44	186990	1684.7	1425.3	140.09	186170	332.64	0.12	depleted
105-072	X09893	REAL	7/6/98	DU 55 GAL DRUM 2/3 FULL OF DRY ICE CREAM CONTAINERS, SAMPLED FROM 4 CONTAINERS ON TOP OF DRUM, SAMPLED MOSTLY BLACK DU WITH SOME GREEN, ONE CONTAINER HAD SAND PAPER	0	16.679	0	903.72	182790	1585.5	1569.4	83.681	181880	338.28	0.13	depleted
105-073	X09875	REAL	7/6/98	55 GAL DRUM PUMPED LIQUID OFF ICE CREAM CONTAINERS ABOUT 2/3 FULL OF ICE CREAM CONTAINERS, REMOVED ABOUT 1/2 THAT CONTAINED SAND PAPER, SAMPLED FROM 1 CONTAINER THAT HAS BLACK PEANUT BUTTER MATERIAL WITH GREEN GRANUALR MATERIAL. LIQUID INTO 55 GAL POLY	0	14.447	0	749.84	161740	1318.3	1275.4	76.38	162620	277.88	0.12	depleted
05-074	X09807	REAL	7/7/98	B-12 WITH NON INTACT 30 GAL DRUM. DRUM HAD GREEN CHIPS + TURNINGS. BOTTOM 4" A BLACK SLUDGE/SOLID MATERIAL. SAMPLED EDGE OF GREEN TURNINGS AND BLACK SLUDGE. SAMPLED TRENCH SIDE.	0	16.169	0	752.16	159920	1337.1	1815.9	85.545	159830	333.31	0.18	depleted
105-075	X09856	REAL	7/7/98	30 GAL OVERPACKED INTO 83 GAL. 30 GAL HALF FULL OF BLACK CHIPS + TURNINGS + SOIL. SOME DROPS OF LIQUIDS. SAMPLED BLACK TURNINGS.	0	15.3075	0	854.485	182740	1521.6	2113.65	92.047	178850	311.435	0.18	depleted

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T-1 Gamma Spectroscopy Data and Summary Information

...mple #	Inner Drum #	QC Type	Collection Date	Event_Comment	All gamma spectrocopy results in pCi/g AC-228 Result	Detection	AM-241 Result	Detection	TH-234 Result	Detection	U-235 Result	Detection	PA-234M Result	Detection	Calculated U mass ratio %(U-235/U-238)	Calculated Uranium Type DU/EU/Natural
2105-076	X09890	REAL	7/7/98	30 GAL FROM LANL, OIL + WATER IN DRUM, LID INTACT, GREEN TURNINGS 2/3 FULL. NO FREE LIQUID, SAMPLED DAMP GREEN TURNINGS	0	32.517	0	1116.7	237750	1963.4	2505	86.747	238630	690.16	0.16	depleted
2105-079	D87702	REAL	7/7/98	30 GAL OVERPACKED INTO NEW 55 GAL. 30 GAL 2/3 FULL OF BLACK GRANUALR PASTE, SOME GREEN. SAMPLED BLACK PASTE	0	15.635	0	902.7	183570	1578.6	2606.6	59.919	184000	298.04	0.22	depleted
2105-080	X09842	REAL	7/7/98	30 GAL OVERPACKED INTO NEW 83 GAL OVERPACK. 30 GAL HAS 2/3 TO 3/4 FULL OF PH=4 LIQUID. PUMPED LIQUID INTO NEW POLY DRUM. SATURATED BLACK PASTE (PEANUT BUTTER0 SOME TURNINGS. SAMPLED BLACK PASTE	0	14.329	0	728.95	153800	1292.1	1803.4	60.758	161260	281.68	0.17	depleted
2105-081	X09839	REAL	7/7/98	30 GAL 2/3 FULL OF GREEN GRANUALR MATERIAL + SOIL, DRY, AT 2" DEEP MATERIAL BECOMES DARK GREEN/BLACK AND MOIST. SAMPLED UPPER 5" OF MIXTURE. OVERPACKED IN NEW 83-GAL.	0	17.973	0	987.09	199830	1767.7	2945.9	93.006	201660	358.31	0.23	depleted
2105-082	D88413	REAL	7/8/98	40 GAL DRUM 3/4 FULL OF GREEN TURNINGS + DRY SOIL, TURNINGS SPRINGY. SPARKED DURING SAMPLING, SAMPLED TURNINGS, OVERPACKED INTO 55 GAL	0	15.429	0	829.82	142130	1438	2070.7	77.402	142710	304.19	0.23	depleted
105-083	D88407	REAL	7/8/98	40 GAL WITH LID, 3/4 FULL OF HARD DENSE DARK GREEN BLACK DU W/ MINIMAL SOIL COVER. CHIPPED DU FOR SAMPLE, SOME SMALL TURNINGS MOIST.	0	15.715	0	788.1	159960	1422.4	2340.5	88.761	167370	316.15	0.22	depleted
105-085	D88417	REAL	7/8/98	40 GAL DRUM LID INTACT 1/2 FULL OF GREEN-BLACK "PEANUT BUTTER" DU + 6" SOIL. SAMPLED DRY SOIL AND DU INTERFACE. OVERPACKED INTO 55 GAL.	0	16.512	0	867.87	179390	1512.4	1696.6	84.585	180690	333.76	0.15	depleted
105-086	D87699	REAL	7/8/98	40 GAL 1/2 FULL OF DU, LID HAS FALLEN IN & DRUM TOP 1/2 FILLED W/ MUD, PUMPED LIQUID PH=7 INTO 55 GAL POLY, SAMPLED DU BELOW LID BLACK TO GREEN SATURATED ALL PEANUT BUTTER CONSISTENCY. OVERPACKED INTO 55 GAL.BOTTLE 002 BROKEN, DRUM SEALED NOT RESAMPLED.	0	13.9775	0	834.07	168675	1456.3	2355.95	92.942	167500	278.615	0.22	depleted
105-087	D88425	REAL	7/8/98	40 GAL WITH LID FULL OF DRY GREEN SPRINGY DU TURNINGS, SAMPLED GREEN TURNINGS, OVERPACKED INTO 55GAL	0	28.13	0	1704	297530	2976.6	3481.9	176.79	298220	576.58	0.18	depleted
05-088	D88387	REAL	7/8/98	40 GAL LID INTACT 2/3 FULL OF BRIGHT GREEN SPRINGY TURNINGS + SOME SOIL, SOME SPARKS DURING SAMPLING, DU ON TOP DRY, AT 6" DEEP DAMP. SAMPLED TURNINGS, OVERPACKED INTO 55 GAL	0	26.758	0	1336	231890	2311.5	2999.4	149.38	267920	520.07	0.17	depleted
05-089	D88388	REAL	7/8/98	40 GAL WITH LID ABOUT 2/3 FULL OF DRY GREEN SPRINGY TURNINGS, WHOLE DRUM DRY, SAMPLED TURNINGS	0	29.681	0	1917.7	314940	3337.1	4325.7	209.24	317130	620.68	0.21	depleted
05-091	D88418	REAL	7/8/98	40 GAL WITH LID 1/2 FULL IF DU W/ LIQUID NON PUMPABLE+SOIL. SAMPLED SATURATED BLACK PASTE	0	15.179	0	882.56	181930	1546.5	2281.3	74.817	179070	303.41	0.20	depleted
05-092	D88414	REAL	7/8/98	40 GAL 2/3 FULL OF SATURATED GREEN SPRINGY TURNINGS, LIQUID 6" BELOW SURFACE NOT PUMPABLE, SAMPLED SATURATED TURNINGS	0	23.597	0	1596.9	285220	2780	4103.1	148.24	280980	460.4	0.23	depleted
05-093	D88410	REAL	7/8/98	40 GAL 3/4 FULL OF GREEN/DRY/SPRINGY/TURNINGS. SAMPLED TURNINGS. SPARKS DURING SMAPLING. OVERPACKED IN 55 GAL	0	29.311	0	1722.9	296680	3157.4	3552	118.4	297050	593.96	0.19	depleted

nple #	Inner Drum #	QC Type	Collection Date	Event_Comment	All gamma spectrocopy results in pCi/g AC-228 Result	Detection	AM-241 Result	Detection	TH-234 Result	Detection	U-235 Result	Detection	PA-234M Result	Detection	Calculated U mass ratio %(U-235/U-238)	Calculated Uranium Type DU/EU/Natural
2105-094	D88415	REAL	7/8/98	40 GAL 3/4 FULL OF DRY GREEN SPRINGY TURNINGS SAMPLED TURNINGS, OVERPACKED INTO 55 GAL	0	25.8	0	1528.7	299210	2702.7	3171.3	172.03	299020	511.24	0.16	depleted
2105-095	D87710	REAL	7/9/98	30 GAL DRY DARK GREENISH CHIPS + TURNINGS, OVERPACKED INTO 55 GAL	0	28.175	0	1914	316660	3381.4	4199.8	201.96	314390	546.51	0.21	depleted
2105-097	D88405	REAL	7/9/98	30 GAL DRY GREENISH/YELLOWISH TURNINGS, POWDERY ON TOP, MOIST BELOW SURFACE, SAMPLED GREENISH + BLACK FLECKS, COMPACTED, OVERPACKED INTO 55 GAL	0	14.676	0	779.89	162150	1318.2	2310.8	97.005	161870	286.37	0.22	depleted
2105-098	D88416	REAL	7/9/98	30 GAL COARSE TURNINGS ON TOP, DAMP, CONSOLIDATED BELOW SURFACE, PASTEY	0	15.632	0	840.19	172300	1465	2611.3	83.154	183190	311.6	0.22	depleted
2105-099	D88412	REAL	7/9/98	30 GAL 3/4 FULL OF GREEN/YELLOW DRY TURNINGS THGOUGHOUT DRUM, OVERPACKED INTO 55 GAL	0	26.6015	0	1684.25	296410	2924.7	3961.15	180.53	296725	530.205	0.21	depleted
2105-100	D88412	DUP	7/9/98	30 GAL 3/4 FULL OF GREEN/YELLOW DRY TURNINGS THGOUGHOUT DRUM, OVERPACKED INTO 55 GAL	0	26.822	0	1549	281450	2706.9	3382.9	127.32	292280	545.46	0.18	depleted
2105-101	D88419	REAL	7/9/98	30 GAL DRY GREENISH/YELLOWISH TURNINGS, DRUM ABOUT 80% FULL, OVERPACKED INTO 55 GAL	0	26.38	0	1784.9	307280	3157.1	3459.7	189.63	317310	547.52	0.17	depleted
2105-102	D88420	REAL	7/9/98	30 GAL 3/4 FULL OF DRY GREEN/YELLOW TURNINGS, OVERPACKED INTO 55 GAL	0	24.931	0	1707.2	295810	3011	3654.5	224.39	303210	494.72	0.19	depleted
2105-104	D88411	REAL	7/9/98	30 GAL 2/3 FULL OF COARSE GREEN TURNINGS ON TOP, FINER YELLOW ISH MATERIAL NEAR BOTTOM, OVERPACKED INTO 55GAL	0	19.705	0	1127.1	225430	1993	2126.6	193.12	223870	410.31	0.15	depleted
2105-105	D88406	REAL	7/9/98	30 GAL 2/3 FULL OF GREEN/YELLOW DRY TURNINGS NEAR TOP, AND BLACKISH SLIGHTLY DAMP MATERIAL BELOW SURFACE. BOTH MATERIALS SAMPLED, OVERPACKED INTO 55 GAL	0	17.331	0	916.26	187320	1619.6	2729.3	75.737	183460	362.43	0.23	depleted
105-106	D92869	REAL	7/9/98	30 GAL 1/2 FULL SURFACE GREEN TURNINGS, BELOW SURFACE SLIGHTLY DAMP AND CONSOLIDATED, OVERPACKED INTO 55 GAL	0	17.101	0	783.46	174230	2062.2	2928.2	109.09	180140	321.75	0.25	depleted
105-107	D92857	REAL	7/9/98	30 GAL 1/2 FULL SURFACE YELLOW/GREEN DRY TURNINGS, 4" BELOW SURFACE DARKER BLACK SLIGHTLY MOIST AND GRANULAR, OVERPACKED INTO 55 GAL	0	23.271	0	1695.6	283460	2940	3430	174.57	298540	463.24	0.18	depleted
105-108	D92858	REAL	7/9/98	30 GAL 1/2 FULL OF MOIST BLACK GRANULAR MATERIAL, OVERPACKED INTO 55 GAL	0	13.902	0	804.71	162960	1417.3	2269.4	90.802	160030	274.32	0.22	depleted
105-110	D92864	REAL	7/9/98	30 GAL 1/2 FULL OF DAMP DARK GREEN TO BLACK GRANULAR MATERIAL, OVERPACKED INTO 55 GAL	0	15.95	0	939.75	186690	1607.8	2513.8	106.73	188190	310.16	0.21	depleted
105-111	D92864	DUP	7/9/98	30 GAL 1/2 FULL OF DAMP DARK GREEN TO BLACK GRANULAR MATERIAL, OVERPACKED INTO 55 GAL	0	18.343	0	1089.85	215310	1903.2	2834.35	122.494	217775	361.61	0.20	depleted
105-112	D92860	REAL	7/9/98	30 GAL 1/3 FULL OF BLACK PASTE, OVERPACKED INTO 55 GAL	0	14.854	0	840.46	173040	1457.3	2401.1	83.573	177870	297.88	0.21	depleted
105-113	D92861	REAL	7/9/98	30 GAL DRUM 1/2 FULL OF BLACK PASTEY MATERIAL WHICH WAS SAMPLED, PUMPED LIQUID PH=4 OUT OF DRUM. HIGH ALPHA FIELD READINGS. OVERPACKED INTO 55GAL	0	14.746	0	815.06	176020	1483.5	2355.8	76.972	173370	290.93	0.21	depleted
105-114	D92859	REAL	7/9/98	30 GAL 1/2 FULL OF BLACK STICKY PASTE, TARRY. OVERPACKED INTO 55 GAL	0	14.989	0	817.38	166550	1366.9	2294.2	73.687	167900	288.59	0.21	depleted
105-115	D92865	REAL	7/13/98	30 GAL 2/3 FULL YELLOW/GREEN DRY TURNINGS AND POWDER, TURNINGS SPARKED WHEN BROKEN, TYPICAL TURNINGS, OVERPACKED IN 55 GAL	0	28.006	0	1874.4	331960	3369.5	3004	218.37	338470	546.23	0.14	depleted

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T-1 Gamma Spectroscopy Data and Summary Information

mple #	Inner Drum #	QC Type	Collection Date	Event_Comment	All gamma spectrocopy results in pCi/g AC-228 Result	Detection	AM-241 Result	Detection	TH-234 Result	Detection	U-235 Result	Detection	PA-234M Result	Detection	Calculated U mass ratio %(U-235/U-238)	Calculated Uranium Type DU/EU/Natural
2105-117	D92868	REAL	7/13/98	30 GAL 1/2 FULL OF DRY BLACK POWDER WITH A FEW VERY FINE TURNINGS, LIMITED SPARKS DURING SAMPLING DUE TO FINER MORE POWDER, OVERPACKED INTO 55	0	22.399	0	1205.7	244970	2104.7	2465.8	126.19	247520	446.92	0.15	depleted
2105-118	D92863	REAL	7/13/98	30 GAL 2/3 FULL OF YELLOW/GREEN AND BLACK DAMP TURNINGS, SPARKED WHEN BROKEN, TYPICAL OF DU TURNINGS, OVERPACKED INTO 55 GAL	0	27.548	0	1507.1	291760	2640.9	2810.5	135.51	297300	583.45	0.15	depleted
2105-119	D92862	REAL	7/13/98	30 GAL YELLOW/GREEN DRY TURNINGS, SPARKED WHEN BROKEN, TYPICAL OF DU TURNINGS, OVERPACKED INTO 55 GAL	0	25.062	0	1726.4	295210	3036.7	3250.8	161.32	304250	515.22	0.17	depleted
2105-120	D92854	REAL	7/13/98	30 GAL 2/3 FULL OF GREENISH BLACK TURNINGS, MOIST, LIQUID NOT PUMPABLE PH=4, TURNINGS TOO WET TO SPARK, OVERPACKED INTO 55 GAL	0	15.243	0	820.62	171610	1458.3	2285.6	107.68	177720	291.73	0.20	depleted
2105-121	D92865	REAL	7/14/98	30 GAL 2/3 FULL OF DRY YELLOW/GREEN COARSE TURNINGS, SPARKED, BOTTLE 003 BROKEN AND DRUM UNABLE TO RESAMPLE, 55 GAL OVERPACK SEALED	0	29.346	0	1913	323550	3303.7	4127.8	186.03	334010	575.45	0.19	depleted
2105-123	D92870	REAL	7/14/98	30 GAL 2/3 FULL OF GREEN TO DARK GREY CHIPS AND GRANULAR MATERIAL MOIST AND DAMP, OVERPACKED INTO 55 GAL	0	14.548	0	760.2	150290	1383.7	1708.6	77.289	176210	286.74	0.15	depleted
2105-124	D92853	REAL	7/14/98	30 GAL YELLOW/GREEN FINE TURNINGS, DRY ON TOP, AT 4" DEPTH DAMP, MODERATE SPARKING WHEN DISTURBED, OVERPACKED INTO 55 GAL	0	27.141	0	1447.2	318330	2567.75	4481.5	140.84	322180	545.155	0.22	depleted
2105-125	D92871	REAL	7/14/98	30 GAL 2/3 FULL OF DAMP COARSE AND FINE YELLOW/GREEN TURNINGS, NO SPARKS, OVERPACKED INTO 55 GAL	0	27.458	0	1720.8	308630	3046.5	4523	230.73	304760	546.38	0.23	depleted
105-126	D92866	REAL	7/14/98	30GAL 1/2 FULL OF DRY MIXTURE OF COARSE AND FINE YELLOW/GREEN TURNINGS, MODERATE SPARKING, OVERPACKED INTO 55 GAL	0	26.549	0	1801.3	321420	3108.4	4149.5	186.87	328510	527.66	0.20	depleted
[illegible]	[illegible]	[illegible]	7/16/98	30 GAL 2/3 FULL OF DRY DARK GREEN COARSE TURNINGS WITH 20-30% FINES, FINES INCREASE WITH DEPTH, MODERATE SPARKING, LOS ALAMOS DRUM, OVERPACKED INTO 55 GAL	0	28.688	0	1819.15	310045	3278	4169.95	176.355	332270	568.305	0.20	depleted
105-129	D93262	REAL	7/16/98	30 GAL 90% FULL OF DRY COARSE YELLOW/GREEN TURNINGS ABOUT 40% FINES, SPARKED WHEN SAMPLED, DUSTIER THAN PREVIOUS, DRUM IMPRINTED WITH LOS ALAMOS, OVERPACKED INTO 55 GAL	0	28.092	0	1814.5	306450	3210.4	4203.5	176.46	313790	560.72	0.21	depleted
105-130	D93269	REAL	7/16/98	30 GAL 50% FULL OF DRY HARD GRANULAR YELLOW/GREEN AND DARKER MATERIAL, LOS ALAMOS DRUM, OVERPACKED INTO 55 GAL	0	18.613	0	1076.3	214500	1934.7	3114	96.547	208700	367.55	0.23	depleted
05-131	D93264	REAL	7/16/98	30 GAL DEFORMED 1/2 FULL OF COARSE DARK GREEN AND BLACKISH TURNINGS, DRY AT SURFACE UNABLE TO PENETRATE FURTHER, OVERPACKED INTO 55 GAL.	0	24.327	0	1291.8	253580	2431	3421.6	148.58	299630	521.83	0.18	depleted
05-132	D93274	REAL	7/20/98	30 GAL 3/4 FULL OF DRY, FINE DARK GREEN + SOME FINE LIGHT GREEN TURNINGS, SPARKED WHEN SAMPLED, OVERPACKED INTO 55 GAL.	0	28.273	0	1902.8	320210	3313.2	4568.9	260.58	334850	585.09	0.21	depleted
05-133	D93270	REAL	7/20/98	30 GAL 80%-90% FULL OF DAMP DARK GREEN AND BLACK CHIPS, TURNINGS AND FINES, "PEANUT BUTTER" CONSISTENCY, NO SPARKS, OVERPACKED INTO 55 GAL.	0	14.161	0	818.83	161230	1414.1	2010.7	78.427	164980	284.53	0.19	depleted

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T-1 Gamma Spectroscopy Data and Summary Information

ple #	Inner Drum #	QC Type	Collection Date	Event_Comment	All gamma spectrocopy results in pCi/g AC-228 Result	Detection	AM-241 Result	Detection	TH-234 Result	Detection	U-235 Result	Detection	PA-234M Result	Detection	Calculated U mass ratio %(U-235/U-238)	Calculated Uranium Type DU/EU/Natural
2105-135	D93271	REAL	7/20/98	30 GAL 50% FULL OF DRY TO DAMP BLACK MATERIAL, NO SPARKS, OVERPACKED INTO 55 GAL.	0	17.575	0	1191	206860	2053	3578.8	116.39	214930	379.01	0.26	depleted
2105-136	D93276	REAL	7/20/98	30 GAL 2/3 FULL OF DRY BLACK/GREEN AND GREY TURNINGS, SPARKED WHEN DISTURBED, OVERPACKED INTO 55 GAL.	0	26.606	0	1907.3	317490	3243.5	3891.7	161.97	327860	532.79	0.18	depleted
2105-137	D93266	REAL	7/20/98	30 GAL 40%-50% FULL OF DAMP DARK GREEN AND BLACK COHESIVE MATERIAL, LIQUID PH=3 PUMPED OFF 10 GALLONS, 4" TO 6" OF WET SLUDGE AT BOTTOM, PLASTIC LINER INTACT, MOST INTACT DRUM TO DATE, OVERPACKED INTO 55 GAL.	0	18.266	0	1229.4	223970	2113.2	1937.3	131.25	222440	345.96	0.14	depleted
105-138	D93282	REAL	7/21/98	30 GAL 2/3 FULL OF LARGER YELLOW/GREEN TURNINGS ON SURFACE, FINELY DIVIDED DAMP GRANUALR MATERIAL BELOW SURFACE, MODERATE SOIL FRACTION MIXED, NO SPARKS, OVERPACKED INTO 55 GAL.	0	17.37	0	824.83	176020	1461.1	2063.1	72.878	173510	361.77	0.18	depleted
105-139	D93260	REAL	7/21/98	30 GAL 80% FULL DRY YELLOW/GREEN TURNINGS, SPARKED, OVERPACKED INTO 55 GAL.	0	20.141	0	1245.4	207340	2228.1	2930.6	116.07	206450	418.9	0.22	depleted
105-141	D92856	REAL	7/21/98	30 GAL 2/3 FULL OF POWDERY, MOIST BLACK/GREEN/YELLOW GRANUALR MATERIAL, NO SPARKING, OVERPACKED INTO 55 GAL	0	21.128	0	1312.5	242310	11938	3532.9	117.83	244980	418.15	0.22	depleted
105-142	D93259	REAL	7/21/98	30 GAL DRUM WITH 2-3 GAL OF PH=7 LIQUID, DRUM 1/2 FULL, LARGE FRACTION OF MUD, DU PEANUT BUTTER CONSISTENCY. NO SPARKS, OVERPACKED INTO 55 GAL.	0	15.054	0	801.33	164030	1460.2	2332	55.415	170440	309.95	0.21	depleted
105-143	D93261	REAL	7/21/98	30 GAL 2/3 FULL OF DRY COARSE TO FINE YELLOW/GREEN TURNINGS, SPARKED, OVERPACKED INTO 55 GAL.	0	27.585	0	1783.4	338790	3104.1	4600.9	181.45	340320	547.62	0.21	depleted
105-145	D93263	REAL	7/21/98	30 GAL 2/3 FULL OF DRY COARSE BLACK TURNINGS ON SURFACE WITH FINER GANULAR MATERIAL BELOW SURFACE (ABOUT 6"), SPARKED WHEN SAMPLED, OVERPACKED INTO 55 GAL.	0	22.489	0	1325.3	249720	2432.9	2685.8	142.91	248840	502.4	0.17	depleted
05-146	D92867	REAL	7/21/98	30 GAL 80% FULL OF DRY COARSE GREEN TURNINGS, SPARKED, OVERPACKED INTO 55 GAL.	0	27.062	0	1681.4	331640	2929.6	4411.3	172.38	333020	543.92	0.21	depleted
05-148	D93273	REAL	7/21/98	30 GAL 50% FULL OF DRY COARSE TURNINGS ON SURFACE TO GRANUALR MATERIAL BELOW SURFACE, YELLOW/GREEN, NO SPARKS, OVERPACKED INTO 55 GAL	0	27.713	0	1905.8	311180	3304.6	4499.8	209	320270	576.43	0.22	depleted
05-149	D93265	REAL	7/21/98	30 GAL 3/4 FULL OF DRY BLACK COARSE TURNINGS ON TOP WITH A MIX OF BLACK TURNINGS AND POWDER DEEPER, SOME SPARKING. "COPIER TONER", OVERPACKED INTO 55 GAL.	0	22.665	0	1550.95	334280	2652.1	4319.6	161.6	339745	447.74	0.20	depleted
05-150	D93275	REAL	7/21/98	30 GAL 2/3 FULL OF DRY MIXED COARSE AND MEDIUM SEGREGATED DARK GREEN TURNINGS, SPARKED, OVERPACKED INTO 55 GAL.	0	30.912	0	1867.6	319430	3276.5	3464.9	165.15	321790	635.66	0.17	depleted
05-151	D93268	REAL	7/21/98	DRUM 1/2 FULL OF WET BLACK PASTE, MOISTURE INCREASES WITH DEPTH, NO SPARKS, OVERPACKED INTO 55 GAL.	0	16.757	0	937.89	191200	1654.9	2616.3	94.678	188510	359.25	0.22	depleted
05-152	D93281	REAL	7/21/98	DRUM 2/3 FULL OF DRY COARSE TO FINE YELLOW/GREEN TURNINGS, SPARKED, OVERPACKED INTO 55 GAL.	0	25.304	0	1591.9	319040	2743.2	4154.4	194.89	323050	553	0.20	depleted

T-1 Gamma Spectroscopy Data and Summary Information

ple #	Inner Drum #	QC Type	Collection Date	Event Comment	All gamma spectrocopy results in pCi/g AC-228 Result	Detection	AM-241 Result	Detection	TH-234 Result	Detection	U-235 Result	Detection	PA-234M Result	Detection	Calculated U mass ratio %(U-235/U-238)	Calculated Uranium Type DU/EU/Natural
2105-153	D93281	DUP	7/21/98	DRUM 2/3 FULL OF DRY COARSE TO FINE YELLOW/GREEN TURNINGS, SPARKED, OVERPACKED INTO 55 GAL.	0	28.975	0	1887.9	314490	3242	4415.8	185.98	312650	604.23	0.22	depleted
2105-155	D93272	REAL	7/22/98	30 GAL 1/2 FULL OF BLACKISH WET SATURATED PASTE, NO SPARKS, OVERPACKED INTO 55 GAL.	0	15.041	0	803.04	165220	1490.6	2036.7	94.83	165470	324.18	0.19	depleted
2105-156	D93267	REAL	7/22/98	30 GAL 1/2 FULL DRY, BLACK AND DARK GREEN COARSE TURNINGS GRADING TO BLACK POWDER AT 6", SPARKED, OVERPACKED INTO 55 GAL.	0	30.576	0	1889.5	326320	3255.7	3655.3	207.04	337370	616.99	0.17	depleted
2105-157	D93278	REAL	7/22/98	30 GAL 2/3 FULL OF DRY COARSE AND FINER TURNINGS, SPARKED, OVERPACKED INTO 55 GAL.	0	28.492	0	1654.4	337580	2971.1	4292.9	159.66	332650	566.75	0.20	depleted
105-158	D93279	REAL	7/22/98	30 GAL DRY COARSE GREEN AND DARK TURNINGS WITH SOME FINES, SPARKED, OVERPACKED INTO 55 GAL.	0	26.077	0	1541.9	322750	2734.2	4199.8	202.25	319560	538.47	0.20	depleted
105-159	D93283	REAL	7/22/98	30 GAL 2/3 FULL OF BLACK MOIST TURNINGS, 1/2 COARSE HALF GRANULAR, SPARKED, OVERPACKED INTO 55 GAL.	0	28.242	0	1911.8	325540	3293.2	4765.2	237.04	331300	565.91	0.22	depleted
105-161	D93285	REAL	7/22/98	30 GAL 1/2 FULL OF MOIST BLACK, MIXTURE OF TURNINGS, CHIPS AND POWDER (50%), NO SPARKS, OVERPACKED INTO 55 GAL.	0	19.433	0	1101.8	248600	1896.2	2634	122.7	246970	408.65	0.17	depleted
105-162	D93277	REAL	7/22/98	30 GAL 90% FULL OF DRY COARSE BLACK AND GREEN TURNINGS, SPARKED, SPRINGY, OVERPACKED INTO 55 GAL.	0	27.454	0	1448.5	304260	2539.9	3308.9	104.18	301730	562.99	0.17	depleted
105-163	D93277	DUP	7/22/98	30 GAL 90% FULL OF DRY COARSE BLACK AND GREEN TURNINGS, SPARKED, SPRINGY, OVERPACKED INTO 55 GAL.	0	29.484	0	1530.6	319880	2839.8	4633	131.79	318390	600.04	0.23	depleted
105-164	D93287	REAL	7/22/98	30 GAL BLACK STICKY PASTE WITH PEANUT BUTTER CONSISTENCY, NO SPARKS, OVERPACKED INTO 55 GAL	0	15.2845	0	855.545	169865	1462.1	2224.3	95.1885	172345	298.98	0.20	depleted
05-165	D93286	REAL	7/22/98	30 GAL 1/2 FULL OF MOIST YELLOW/GREEN GRANULAR COHESIVE MATERIAL, DENSELY PACKED, DIFFICULT TO PENETRATE MORE THAN 8" DEEP, NO SPARKS, OVERPACKED INTO 55 GAL.	0	16.769	0	917.45	182540	1633.3	1958.9	107.3	181610	343.91	0.17	depleted
05-166	D93288	REAL	7/22/98	30 GAL 1/2 FULL OF HARD CONSOLIDATED DARK GREEN TO BROWN/BLACK GRANUALR, NO SPRAKS, SAMPLES HAD TO BE CHIPPED LOOSE, OVERPACKED INTO 55 GAL.	0	18.404	0	1014.3	199480	1790.5	2838.2	92.786	207300	379.52	0.21	depleted
05-167	D93288	DUP	7/22/98	30 GAL 1/2 FULL OF HARD CONSOLIDATED DARK GREEN TO BROWN/BLACK GRANUALR, NO SPRAKS, SAMPLES HAD TO BE CHIPPED LOOSE, OVERPACKED INTO 55 GAL.	0	19.672	0	1125.2	213530	2029	2789.8	119.2	221480	411.84	0.20	depleted
05-169	D93284	REAL	7/22/98	30 GAL 80% FULL OF MIXED DRY YELLOW/GREEN COARSE, MEDIUM AND FINE TURNINGS, OVERPACKED INTO 55 GAL.	0	20.742	0	1381.6	340110	2377.9	3785.6	135.94	351240	412.12	0.17	depleted
05-170	D93280	REAL	7/22/98	30 GAL 2/3 FULL OF DRY YELLOW/GREEN TURNINGS TO 4" FROM BOTTOM. BOTTOM 4" MOIST/WET. SAMPLED UPPER LAYER, SPARKED. OVERPACKED INTO 55 GAL.	0	24.604	0	1317.2	329140	2320.3	2828.8	114.28	318630	524.02	0.14	depleted
05-171	D93462	REAL	7/22/98	30 GAL 2/3 FULL FAIRLY DRY YELLOW/GREEN TURNINGS AND GRANUALS, NO SPARKS, OVERPACKED INTO 55 GAL.	0	20.7965	0	1096.75	228360	1921.55	2216.65	107.724	219360	420.67	0.16	depleted
05-172	X10374	REAL	7/28/98	55 GAL 2/3 FULL OF COARSE BLACK AND GREENISH TURNINGS, DRY FROM SURFACE TO BOTTOM, FEW SPARKS WHEN SAMPLED, OVERPACKED INTO 85 GAL.	0	26.657	0	1667.4	324890	2885.4	3444.9	153.9	324010	532.1	0.17	depleted

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T-1 Gamma Spectroscopy Data and Summary Information

mple #	Inner Drum #	QC Type	Collection Date	Event_Comment	AC-228 Result	AC-228 Detection	AM-241 Result	AM-241 Detection	TH-234 Result	TH-234 Detection	U-235 Result	U-235 Detection	PA-234M Result	PA-234M Detection	Calculated U mass ratio %(U-235/U-238)	Calculated Uranium Type DU/EU/Natural
					All gamma spectrocopy results in pCi/g											
2105-173	X10371	REAL	7/28/98	55 GAL 1/2 FULL OF WET BLACK DU CHIPS AND POWDER, SURFACE GREEN AND YELLOW, NO PUMPABLE LIQUIDS, NO SPARKS, OVERPACKED INTO 85 GAL.	0	16.678	0	913.18	187840	1547.4	2222.8	122.98	181190	339.95	0.19	depleted
2105-176	X09806	REAL	7/29/98	B-12 GREEN AND YELLOW GRANULAR DAMP MATERIAL, SLIGHTLY COHESIVE, NO SPARKS, DRUM 1/3 FULL, MAJORITY OF DU WAS IN A SOLID MASS VERY COMPACT.	0	16.655	0	786.66	161670	1426.6	1774.1	52.411	172770	345.86	0.16	depleted
2105-177	D93457	REAL	7/30/98	30 GAL 1/2 FULL OF GREEN/BROWN AND BLACK TURNINGS AND GRANULAR MATERIAL, SLIGHTLY DAMP, NO SPARKS,DRUM ABOUT 30%-40% FULL OF TRASH MATERIAL, PAPER WIPES,SAND PAPER, OVERPACKED INTO 55 GAL.	0	18.853	0	936.99	182550	1684.3	3015	100.13	180920	377.98	0.26	depleted
2105-178	D93461	REAL	7/30/98	30 GAL 2/3 FULL OF GREEN/YELLOW GRANUALR MATERIAL WITH SOME TURNINGS, SLIGHTLY DAMP, NO SPARKS, OVERPACKED INTO 55 GAL.	0	17.167	0	767.53	159710	1356.5	2050.6	99.136	170820	354.91	0.19	depleted
2105-179	D93466	REAL	8/3/98	30 GAL 2/3 FULL OF SLIGHTLY DAMP-LOOSE COMPACTED GREENISH GRANULAR MATERIAL, DRUM CONSISTENT TOP TO BOTTOM, NO LIQUIDS PRESENT, NO SPARKS, OVERPACKED INTO 55 GAL.	0	19.554	0	1053.5	201670	1896.5	2608.2	92.683	205160	413.97	0.20	depleted
105-181	D93469	REAL	8/3/98	30 GAL 80% FULL, TOP HALF OF DRUM LOOSELY COMPACTED, DAMP, GREENISH GRANULAR POWDER, BOTTOM HALF OF DRUM CONTAINED TIGHTLY COMPACTED MATERIAL THAT COULD NOT BE PENETRATED WITH THE WRECKING BAR, NO SPARKS, NO LIQUID, OVERPACKED INTO 55 GAL.	0	19.428	0	979.18	199600	1750.8	2778.6	101.94	204910	395.48	0.21	depleted
105-182	X10398	REAL	8/3/98	55 GAL 80% FULL, TOP 6" COARSE TURNINGS, FEW SHINY METAL (STAINLESS?) INTERMIXED WITH DU TURNINGS, REST OF DRUM TIGHTLY COMPACTED POWDER AND GRANULAR MATERIAL, ALL DU GREENISH, NO WATER PRESENT, TURNINGS DID SPARK, OVERPACKED INTO 85 GAL.	0	22.682	0	1326.8	232770	2350.9	3817.7	109.95	249445	459.885	0.24	depleted
105-183	X10375	REAL	8/4/98	30 GAL WITHOUT LID IN 55 GAL, ANNULAS BETWEEN 30/55 FILLED WITH FINE "GRAPHITE" POWDER (DARK GREY MATERIAL), 30 GAL FULL TO TOP, ONLY BOTTOM 6" OF GREEN GRANUALR DU MATERIAL, DU SLIGHTLY DAMP , NO SPARKS, SOME GRAPHITE IN SAMPLE, OVERPACKED INTO 85 GAL	0	13.62	0	655.48	163600	1183.1	2232.1	60.626	156090	289.07	0.22	depleted
105-184	X09834	REAL	8/5/98	B-12 SAMPLES COMPOSITED FROM TWO GRABS FROM 2 DRUMS IN B-12, SAMPLES GREEN AND YELLOW GRANUALS, SLIGHTLY MOIST AND COHESIVE, SEPARATED FROM CHUNKS, NO SPARKS.	0	14.367	0	695.96	147290	1218.8	1830.1	72.541	146800	291.06	0.19	depleted
105-187	X09829	REAL	8/5/98	5 GAL PAIL W/ 3 JARS (~500ML) OF MATERIAL, SAMPLED FROM 2 JARS, GREY DARK MATERIAL, NO SPARKS, JARS WENT INTO A 1 GAL CAN AND PALCED IN THE WASTE DRUM, SAMPLE IN GAMMA SPEC HARD CORE/PLUG BROKEN W/ WRECKING BAR, SAMPLE IN VOA/PCH SAME +OTHER. MAYBE UH3.	0	15.66	0	904.55	232370	1765.7	9659.7	73.859	230280	329.72	0.65	natural

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T-1 Gamma Spectroscopy Data and Summary Information

mple #	Inner Drum #	QC Type	Collection Date	Event Comment	All gamma spectrocopy results in pCi/g AC-228 Result	Detection	AM-241 Result	Detection	TH-234 Result	Detection	U-235 Result	Detection	PA-234M Result	Detection	Calculated U mass ratio %(U-235/U-238)	Calculated Uranium Type DU/EU/Natural
2105-189	X09805	REAL	8/17/98	B-12 3/4 FULL OF SOIL, DUG TO BOTTOM IN 5 SPOTS, FOUND 1 DU CHIP, RAD SUVEYED MINIMAL RAD LEVELS, 5 LOCATIONS COMPOSITED, DU CHIP IN GAMMA SPEC BOTTLE, NO INERTING SOIL ADDED.	0	0.83069	0	0.73631	64.706	2.6204	2.0506	0.15759	64.157	18.22	0.50	natural
2105-190	X09822	REAL	8/17/98	B-12 90% FULL OF SOIL, DUG 3 HOLES, BOTH ENDS AND MIDDLE OF BOX, SAMPLED FROM EDGE OF EACH HOLE FOR A TOTAL OF 6 LOCATIONS SAMPLED, MATERIAL COMPOSITED INCLUDED ABOUT 100 ML OF DU, DU SIZE REDUCED WITH SHOVEL, AND COMPOSITED WITH SOIL.	0	2.5542	136.3	7.6043	6553.6	24.921	131.2	1.5536	6602.9	86.339	0.31	depleted
2105-191	X09822	DUP	8/17/98	B-12 90% FULL OF SOIL, DUG 3 HOLES, BOTH ENDS AND MIDDLE OF BOX, SAMPLED FROM EDGE OF EACH HOLE FOR A TOTAL OF 6 LOCATIONS SAMPLED, MATERIAL COMPOSITED INCLUDED ABOUT 100 ML OF DU, DU SIZE REDUCED WITH SHOVEL, AND COMPOSITED WITH SOIL.	0	2.6539	170.79	8.2137	7611.6	26.49	147	2.3372	7518.5	42.69	0.30	depleted
2105-192	X09821	REAL	8/18/98	B-12 85% FULL, DUG HOLES AT BOTH ENDS, SAMPLED LARGER CHUNKS OF DU, CHUNKS PLACED IN PLASTIC BAG AND SIZE REDUCED WITH SLEDGE HAMMER, FINE MATERIAL WAS THEN PLACED IN SAMPLE JARS, DU WAS A COMBINATION OF YELLOW AND PALE GREEN.	0	22.459	0	226.78	147610	969.17	2420.1	67.855	140780	481.47	0.27	depleted
2105-194	X09798	REAL	8/18/98	B-12 85% FULL, EXCAVATED AT BOTH ENDS AND MIDDLE, SAMPLED CHUNKS OF SUSPECTED DU INTO PLASTIC BAG AND SIZE REDUCED WITH SHOVEL AND TAMPING W/ SLEDGE, FINES PLACED INTO SAMPLE JARS, DU GENERALLY BLACK, SOME BRIGHTEST GREEN SEEN TO DATE.	0	18.325	0	151.72	103690	656.14	1880.9	59.75	101130	745.56	0.29	depleted
105-195	X09801	REAL	8/19/98	B-12 EXCAVATED SOIL AND RCT SCREENED, SAMPLED FROM BOTH ENDS, COMPOSITED INTO PLASTIC BAG, THEN CHUNKS SIZE REDUCED BY TAMPING WITH SLEGDE, MATERIAL WAS DU YELLOW/GREEN AND SOIL.	0	16.113	0	116.99	85219	490.77	1519.9	31.123	85369	377.53	0.28	depleted
105-196	X09809	REAL	8/19/98	B-12 EXCAVATED 4 HOLES AT OPPOSITE ENDS OF B-12 AND LOCATED MATERIAL WITH HIGHER RADIATION LEVELS WITH RCT, CHUNKS SIZE REDUCED IN PLASTIC BAG, SAMPLED FROM BAG, MATERIAL RED/BROWN WITH SOME GREEN.	0	13.926	0	53.71	42450	251.45	766.27	19.206	42258	484.85	0.28	depleted
105-197	X09810	REAL	8/19/98	B-12 BIASED COMPOSITE FROM 4 CORNERS OF B-12, YELLOW/GREEN MATERIAL EASY TO VISUALLY IDENTIFY.	0	22.064	0	178.73	124020	795.45	2050.5	53.135	133030	482.72	0.24	depleted
105-198	X09800	REAL	8/19/98	B-12 BIASED SAMPLE FROM 4 CORNERS OF B-12, MATERIAL LOCATED VISUALLY AND BY RAD LEVELS, COMPOSITED AND SIZE REDUCED IN PLASTIC BAG, JARS FILLED FROM BAG, MATERIAL DARK GREEN WITH SOME YELLOW.	0	17.74	0	132.28	96108	581.8	1585.2	59.374	96197	381.41	0.26	depleted
105-200	X09799	REAL	8/19/98	B-12 BIASED COMPOSITE BASED ON VISUAL AND RAD LEVELS, MATERIAL DARK BROWN MIXED WITH SOIL.	0	8.66965	0	24.7205	14337	109.99	270.495	5.95775	14216	292.89	0.30	depleted
105-201	X09804	REAL	8/19/98	B-12 BIASED COMPOSITE FROM VISUAL AND WITH RAD LEVELS, MATERIAL BROWN/BLACK MIXED WITH SOIL.	0.60405	1.57815	0	6.9181	6000.35	25.7315	101.254	1.9399	5457.85	82.0945	0.29	depleted

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T-1 Gamma Spectroscopy Data and Summary Information

mple #	Inner Drum #	QC Type	Collection Date	Event_Comment	All gamma spectrocopy results in pCi/g AC-228 Result	Detection	AM-241 Result	Detection	TH-234 Result	Detection	U-235 Result	Detection	PA-234M Result	Detection	Calculated U mass ratio %(U-235/U-238)	Calculated Uranium Type DU/EU/Natural
2105-202	X09803	REAL	8/26/98	B-12 1/2 FULL, EXCAVATED INSIDE B-12 LOCATED MATERIAL VISUALLY AND W/ RAD LEVELS, MATERAIL GREEN AND IN CLUMPS, COLLECTED INTO PLASTIC BAG AND SIZE REDUCED, NO SPARKS, FILLED B-12 TO CAPACITY W/ SOIL,	0	17.813	331.06	147.29	89923	524.31	1728.5	43.658	90586	696.96	0.30	depleted
2105-203	X09829	REAL	9/1/98	B-12 2/3 FULL SEARCHED FOR HISTORICAL GLASS SAMPLE JARS, LOCATED ONE ~4" BY 1.5" CYLINDRER OF BLACK HARD MATERIAL, SIZE REDUCED IN PLASTIC BAG, MATERIAL MOST LIKELY CAME OUT OF SAMPLE JAR DURING EXCAVATION.	0	23.716									#DIV/0!	#DIV/0!
2105-204	X09829	REAL	9/1/98	CONTENTS OF D93470 (1/2 FULL 55 GAL) EMPTIED IN B-12 X09829, ONE INTACT OLD SAMPLE JAR ~30 ML FOUND, BOTTLE BROKEN INSIDE A PLASTIC BAG , THEN SAMPLED, ONLY A MARBLE SIZE AMOUNT OF BLACK MATERIAL PRESENT AND SAMPLED.	0	35.276	0	109.03	326400	454.63	11131	33.223	329480	689.03	0.53	natural
2105-207	X09829	REAL	9/2/98	B-12 A 3" DIAMETER BY 2" HIGH CYLINDER WAS LOCATED VISUALLY AND WITH RAD. CYLINDER DARK GREEN WITH YELLOW HIGHLIGHTS, MATERIAL SIZE REDUCED IN PLASTIC BAG, THEN SAMPLED.	0	21.386	0	191.48	123640	881.46	4661.3	55.034	123580	491.1	0.59	natural

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Appendix D-3
T-1 Decanted Lathe Coolant Information

l Decanted Lathe Coolant

quids in 55-gal poly drums

				All Rad in pCi/L		mass ratio			Fingerprint parameters					All Chemicals in mg/l					
N-Event	Location	Field OVA (ppm)	Field Description	U-238	U-235	U235/U238	AM-241	559 - g/L Pu	pH	flash point	spec gravity	miscible w/	Physical Desciption	PCE	TCE	TICs	Arochlor-1254	Cyanide	Metals
2106-001	X07938	not taken	single phase (with dark brown percip), yellowish	1,610.00	75.00	0.72	<68	<16000	6.5	NA-aqueous	0.9946	water	Single phase, non-viscous, transparent, colorless liquid	0.037	0.024		0.09 U	0.023	A few low detections
2106-002	X07927	115 PID	single phase, dark brown, oil sheen, half full drum	77,400.00	1,160.00	0.23	<270	35200	6.0	NA-aqueous	0.9963	water	Single phase, non-viscous, transparent, colorless liquid	0.25 UD	0.25 UD	Fuel?	0.21	0.077	A few low detections
2106-003	X07935	1500 FID, 350 PID	Bottom phase, dark greenish-brown - 3.5" (sample layered)	264,000.00	5,230.00	0.31	<591	Top=692000, Bottom=196000	5 - 6.5	NA-aqueous	about 1	water	Top layer: opaque, non-viscous, grayish liquid (3%), Bottom layer, transparent, non-viscous, colorless liquid (97%)	0.7 J	1.3 U	Fuel?	76 D	0.072	A few low detections
2106-004	X07935	1500 FID, 350 PID	Top phase, medium brown/tan - 6.5"	125,000.00	1,510.00	0.19	<391	58900	NA	77.3 C	0.8106	organics	single phase, slightly viscous, transparent, light yellow liquid	2.400	1.3 U	Fuel?	112 D	0.117	A few low detections

Salomon, Hopi

From: Salomon, Hopi
ent: Wednesday, September 30, 1998 1:06 PM
o: Sproles, Wayne; Estabrooks, Bates; Burmeister, Mark
Cc: Henderson, Roger
Subject: FW: 98A2106 Samples

It is probably safe to assume that the Pu results from the subject samples are in fact not contaminated with Pu. I say this with confidence because Pu was never identified in any significant concentration in the T-1 DU samples analyzed using radiochemical techniques at 559.

-----Original Message-----
From: Henderson, Roger
Sent: Wednesday, September 30, 1998 10:39 AM
To: Salomon, Hopi
Subject: 98A2106 Samples

The group of samples under the APO ID number 98A2106 were analyzed using our methods normally utilized for 374 Liquid Waste Treatment Operations Samples. This generates g/l results and does not use a separation scheme that would separate Pu and U. Hence, elevated U levels in a sample can cause artificially high levels of Pu to be reported, as is most likely the case in these samples, which did show some ^{235}U levels above the method MDA.

I hope this clears any concerns regarding the reported results.

Roger.

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Appendix D-4
T-1 Cemented Cyanide Reclassification Letter

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RMRS Rocky Mountain Remediation Services, L.L.C.
. . . protecting the environment

INTEROFFICE CORRESPONDENCE

DATE: November 5, 1998

TO: Bob Griffis, Trench 1 Project Manager, x4934, T893B
Ted Hopkins, Manager Environmental Compliance, x7652, B116

FROM: Hopi Salomon, Trench 1 Project, x6627, T893B HS

SUBJECT: TRENCH 1 CEMENTED CYANIDE WASTESTREAM RECLASSIFICATION - HS-002-98

During the excavation phase of the Trench-1 (T-1) Source Removal project, ten 55-gallon drums of unsolidified cemented cyanide waste were exhumed from the trench. Several issues exist regarding the classification of this waste. This letter was prepared to summarize the existing analytical data, present the current waste classification and associated issues, and then present a case for modification of the current classification. Treatment standards resulting from new regulations that effect this waste will then be presented. If acceptable, concurrence to a modification of the waste classification will be granted by signing the concurrence line at the end of this letter.

Summary of existing analytical information

Samples were collected from each of the ten drums for gamma spectroscopy and total cyanide analysis. All results indicate low level uranium contamination and significant levels of cyanide (0.51 - 5.3 weight %). Most of the drums appeared to contain asbestos fibers; two drums were sampled for asbestos analysis and both contained significant asbestos (15 and 25% by volume). Four samples were collected from three of the drums (this included one duplicate) and were analyzed for VOCs/SVOCs, the full TCLP list, reactive sulfide, reactive cyanide, corrosivity, and isotopic Pu, Am, U, as well as additional gamma spectroscopy. I believe that these four samples are representative of the entire wastestream. A summary of the analytical results follows:

No VOCs or SVOCs were detected

All samples exceeded TCLP thresholds for cadmium (829-1,200 mg/L)

No other TCLP thresholds were exceeded

pH was in the range of 12.4-13.2

Reactive Sulfide was undetected (though holding time was missed by a few days)

Reactive Cyanide: Three of four samples reported as undetected. One sample reported as 0.3 mg/kg reactive cyanide.

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The original, complete data set collected to characterize this waste can be found in the K-H Analytical Services Division vault under report Identification Number (RIN) 98A2109.

Current Waste Classification

Currently, the cemented cyanide is classified as D006 for exceeding the TCLP threshold for cadmium. Since the waste is not an aqueous solution or liquid, the characteristic standard for corrosivity did not apply.

As far as issues regarding D003 codes for reactive cyanide or F-listing based on the original generation process, let me give you some information from the approved PAM (RF/RMRS-97-011, the project specific Decision Document). This comes from Section 5.2.2, Identification and Listing of Hazardous or TSCA (PCB) Wastes:

> *The historical record indicates that 10 drums of cemented cyanide wastes were disposed in T-1. The cyanide wastes could have originated from either listed electroplating sources or non-listed heat treating activities conducted in building 444. Because of the uncertainty as to the source, any cyanide waste, soil/waste mixtures, debris or wastewater will be considered potentially reactive until tested and determined otherwise. (See 40 CFR § 261.23(a)(5)). Where appropriate, any cyanide waste, soil/waste mixtures, debris, or wastewater will be evaluated for other hazardous waste characteristics.*

As the PAM excerpt presented above indicates, applying an F-listed code to the waste was believed to be inappropriate because the exact generation process could not be identified (this will be discussed later in this paper). Proper characterization of the waste with respect to D003 (cyanide reactivity) was an unresolved waste characterization issue. As you are aware, EPA has recently withdrawn the Cyanide and Sulfide Reactivity Guidance (see RCRA Holtline Faxback 14177). This appears to be a result of concerns raised about the appropriateness of SW-846 test method used for evaluating reactive cyanide, and the fact that the waste being evaluated would not necessarily be subject to a range of pH conditions between 2 and 12.5.

EPA further states:

> *Until revised guidance is developed, we* (EPA) *reiterate the RCRA regulatory language. That is, 40 CFR 261.23(a)(5) specifies that human health and the environment must not be endangered by evolved toxic gases when these wastes are exposed to pH conditions between 2 and 12.5. Any waste causing a hazard, when in the pH range of 2-12.5 would certainly be considered a characteristic hazardous waste.*
>
> *We understand that withdrawal of the guidance today means that waste generators that have relied on this guidance in the past will, in the near term, have greater uncertainty about determining the regulatory status of their cyanide- and sulfide-bearing wastes. However, the Agency believes that generators of sulfide-and cyanide-bearing wastes can recognize the acute toxicity of sulfides and cyanides without relying on the test in the guidance. Where wastes with high concentrations of soluble sulfides and cyanides are being managed, generators have relied on their knowledge of the waste to classify them as D003. The Agency expects that generators should continue to classify their high*

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concentration sulfide- and cyanide-bearing wastes as hazardous based on the narrative standard.

Based on the issues associated with the test method and EPA's recent statements I believe that we do not have the necessary information to make an informed decision on whether or not this wastestream should be characterized as reactive. However, this may be a moot point. Issues have surfaced regarding the initial characterization as non-listed. If the waste is determined to be listed, the same treatment standards required for reactive cyanide waste will be required based on the LDR requirements for the listing. The following section elaborates on this issue.

Proposed Modification to the Current Waste Classification

As noted in the PAM, the cyanide wastes could have originated from either listed electroplating sources or non-listed heat treatment operations conducted in building 444 (Note that some heat treatment operations involving cyanides are "listed" under RCRA (see waste descriptions for F010 - F012 wastes in 40 CFR 261.31)). The heat treatment source was identified during interviews conducted by T-1 personnel with past Building 444 personnel on January 23, 1997. Summary information from the interview state that cyanide salt was used in the Precision Shop for "carbonizing" (heat treat furnace). Section 4.4.7.2 of the Rocky Flats Historical Release Report (HRR), Building Histories document (November, 1994) discusses the heat treatment operations conducted in Building 444 but makes no mention of cyanide used in the process. However, cyanides are often associated with heat treatment operations as indicated by RCRA.

The HRR does however make reference to electroplating operations involving both cyanide and cadmium in Building 444. Prior to excavation and analytical testing the cyanide waste was not specifically known to be associated with cadmium. However, as the analytical results indicate, cadmium is a major part of the cemented cyanide wastestream. With the current information, it makes it difficult not to associate the cemented cyanide to a listed electroplating operation or listed heat treatment operation involving both cyanide and cadmium.

All of the associated "listed-waste" codes associated with electroplating or heat treatment operations have the same treatment standards except one, F010. The F010 code is described in 40 CFR 261.31 as "*Quenching bath residues from oil baths from metal heat treating operations where cyanides are used in the process.*". The treatment standards for F010 only includes standards for cyanide and not any metal constituents required by the F006-F009 treatment standards for electroplating and F011 and F012 for other heat treatment operations. As a result of the high cadmium concentrations, it is unlikely that the F010 code should apply. Another factor is that the HRR indicates that no radioactive materials were allowed in the heat treatment yet the cemented cyanides are radioactively contaminated. Furthermore, waste generated from electroplating operations involving cadmium would be expected to have higher cadmium concentrations than waste generated from heat treatment operations, indicating that it is more appropriate to code the waste with a F006-F009 than an F011 or F012 code.

Finally, it is impossible to ascertain which portion of the electroplating process (if not all) made up the waste exhumed during the T-1 excavation. It is more likely that the waste was associated with a sludge (F006) or residue (F008) which could have been drummed as opposed to an electroplating waste solution (F007, F009), as these would have typically been sent to the onsite water treatment facility when produced.

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Finally, all electroplating waste codes that could be associated with the ten drums of cemented cyanides have identical treatment standards. However, to simplify the coding and since all the treatment standards are the same, the two most likely electroplating codes (those involving sludges and residues) have been chosen. These codes, are F006 and F008 and are defined as "Wastewater treatment sludges from electroplating operations...", and "Plating bath residues from the bottom of plating baths from electroplating operations where cyanides are used in the process", respectively. These should be considered the only hazardous waste codes associated with the cemented cyanides.

New Regulations Effecting Final Disposal

The new Phase IV LDR Regulations affecting land disposal of hazardous waste were promulgated by EPA on May 26, 1998 (63 FR 18556-28753). These regulations have not yet been adopted by Colorado, however they may impact final offsite disposal. To account for any potential disposal option, it is suggested that any future treatment contracts for the cemented cyanide wastestream require the most stringent treatment standards for F006 or F008 waste. This conservative strategy was also advocated by Andy Drom of Envirocare of Utah, Inc., in a recent telephone conversation with Robert Cygnarowicz and myself .

The following table lists the current Colorado treatment standards found in 6 CCR 1007-3, Section 268.40 and the Federal standards that will be incorporated into the next issuance of 40 CFR 268.40, as well as the proposed standards for our waste

Treatment Standards for the T-1 Cemented Cyanide Waste

Waste Codes	Waste Descriptions	Common Name	Current Colorado Nonwastewater Treatment Standard	Phase IV LDR Nonwastewater Treatment Standard	Project Required Nonwastewater Treatment Standard
F006	Wastewater treatment sludges from electroplating operations...	Cadmium	0.19 mg/L TCLP	0.11 mg/L TCLP	0.11 mg/L TCLP
		Chromium (Total)	0.86 mg/L TCLP	0.60 mg/L TCLP	0.60 mg/L TCLP
		Cyanides (Total)	590 mg/Kg	590 mg/Kg	590 mg/Kg
F008	Plating bath residues from the bottom of plating baths...	Cyanides (Amenable)	30 mg/Kg	30 mg/Kg	30 mg/Kg
		Lead	0.37 mg/L TCLP	0.75 mg/L TCLP	0.37 mg/L TCLP
		Nickel	5.0 mg/L TCLP	11 mg/L TCLP	5.0 mg/L TCLP
		Silver	0.30 mg/L TCLP	0.14 mg/L TCLP	0.14 mg/L TCLP

The current analytical data indicates that only the TCLP cadmium and total cyanide concentration standards are currently exceeded. However, it should be noted that because of high levels of cadmium in the cemented cyanide, the samples required some dilution by the analytical laboratory, causing the detection levels for other metals to be elevated. As a result, some of the samples indicate non-detections for lead and silver, however at levels slightly above the proposed treatment standards. Following immobilization of the cadmium through treatment, this matrix interference problem described above should cease.

Conclusion

A strong case can be made to reclassify the ten drums of cemented cyanide waste as F006 and F008. Final treatment should accomplish two goals:

1) Immobilize the cadmium such that it will pass a 0.11 mg/L TCLP leach test for cadmium, and

2) Reduce the total cyanide concentration to below 590 mg/Kg.

The final waste form must be such that the asbestos waste contained in the cemented cyanide matrix is not friable.

If you concur, with the reclassification of the wastestream as well as proposed treatment standards suggested please sign on the concurrence line below. If you have any question please call me at extension 6627.

Concurrence:

R L Griffis
Bob Griffis
Trench 1 Project Manager

Ted A Hopkins
Ted Hopkins
Manager Environmental Compliance

HS/aw

cc:
Marla Broussard
Mark Burmeister
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Robert Cygnarowicz
Tom Greengard
Ted Hopkins
Julie Horton
Mike Pepping
Florence Phillips
Jim Schoen
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Appendix E
Post Excavation Geophysical Survey

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GEOPHYSICAL SURVEYS PERFORMED AT THE TRENCH 1 SITE OF THE ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE GOLDEN, COLORADO

Blackhawk Geometrics Project Number 9914RMR

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January 26, 1999

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1.0 INTRODUCTION

This report covers the procedures and results of geophysical surveys performed at the Trench 1 Site of the Rocky Flats Environmental Technology Site, Golden, Colorado. The fieldwork was done on January 21, 1999, by Blackhawk Geometrics, Inc. (Blackhawk) for Rocky Mountain Remediation Services, L.L.C., (RMRS).

The objective of the surveys was to identify buried metal objects within a six-foot swath surrounding the approximately 200 feet long and 15 feet wide Trench 1. This information would be used to evaluate the potential of additional buried hazardous material at the trench site. To meet the survey objectives, an electromagnetic metal detection survey utilizing the Geonics EM61 High Resolution Metal Detection System was carried out. An additional magnetic survey utilizing a Geometrics G-858 Cesium vapor magnetometer was also done at the site.

2.0 SURVEY PROCEDURES

The data for both the magnetometer and EM61 surveys were collected along survey lines spaced three feet apart and orientated parallel to the long axis (east-west) direction of the trench. A data point was collected every 0.6 feet along the survey line for the EM61 and every 0.2 feet for the magnetometer. This resulted in 100% coverage of the six-foot wide survey swath around Trench 1. The survey requirements were that a five-gallon metal drum at a depth of six feet be detectable. An object this size and at this depth should be near the limit of detectability for the EM61 and should be easily detectable with the magnetic data assuming no significant "noise." Descriptions of the EM-61 and magnetometer systems are contained in Appendix A.

The Trench 1 site is located within a tent structure supported with aluminum beams and tied down with ferrous metal rebar. The north wall of the structure is approximately 12 feet from the edge of the trench. The proximity of metal within the wall affected both EM and magnetic data collected on the north side of the trench.

The EM-61 data were collected with two coils. The lower coil, which is both a transmitter and receiver coil (See Appendix A), was located at a distance of 16 inches above the ground. The lower coil is primarily utilized to identify buried metal. The upper coil (receiving coil) is located 16 inches above the lower coil. The upper coil is utilized for depth estimates of buried objects.

The magnetometer data was collected with a single sensor positioned on a wheeled cart 20 inches above the ground surface. Total magnetic field data were recorded. Due to the short time it took to collect the data less than half an hour and relatively large anomalies (>50 gammas), no diurnal corrections were applied to the data.

The four corners of the survey grid were marked on the ground with plastic wiskers. The 0,0 and 0,30 points were labeled with paint on the ground. The grid was also tied to a control survey point located at grid point 6,12 and to the other cultural features within and adjacent to the survey area. The survey lines were marked with plastic measuring tapes, and the two instruments were run along the tapelines.

3.0 RESULTS

The EM61 lower coil and magnetometer data were gridded and color shaded utilizing the Geosoft™ geophysical processing software. These color contour maps are shown in Figures 3-1 and 3-2. Utilizing primarily the EM61 data, 13 individual anomalies were picked and three anomalous zones identified. The locations of these anomalies are shown in Figures 3-1 and 3-2 and are listed in Table 3-1.

TABLE 3-1

ANOMALY LOCATIONS

Anomaly #	Center Location X	Center Location Y	Magnitude (millivolts)	Cause	Depth
1	6	12	203	Survey Pin?	8 inches
2	6	150	75	Unknown	20 inches
3	6	183	10	Unknown	4 inches
4	6	186	16	Unknown	<10 inches
5	25	162	21	Unknown	-
6	24	145	23	Unknown	-
7	24	143	24	Unknown	-
8	24	110	17	Unknown	-
9	24	102	16	Unknown	-
10	24	79	98	Buried Drum	-
11	24	57	128	Unknown	-
12	24	42	90	Unknown	-
13	24	14	53	Survey Pin ?	-

Zone	Extent X	Extent Y	Range of Magnitude (millivolts)
A	24 to 30	216 to 250	20 to 150
B	24 to 30	157 to 175	10 to 24
C	24 to 30	5 to 65	40 to 135

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3.2 EM61 Data

The results of the EM61 survey are shown in Figure 3-1. The data shows significant differences from the north and south sides of the trench. This is likely the result of the proximity of the temporary structure metal supports, vents, and doors, which are located approximately six feet north of the survey grid. In addition, there appears to be a larger number of buried metal items on the north side of the trench area.

Along the south edge of Trench 1, the background EM61 readings range from 0 to 2 millivolts. Four buried metal objects are identified along this side of the trench and are labeled 1 through 4 on both Figure 3-1 and Table 3-1. Anomaly 1 is located at the Trench 1 survey control point. It is likely caused by a metal survey stake driven into the ground, although no stake was visible at the surface. Anomalies 2, 3, and 4 are relatively small in areal extent and are interpreted to be shallow (<20 inches).

Along the northern side of the trench, three zones are mapped which appear to contain numerous buried metal objects and/or have significant interference from metal within the building wall. These zones are labeled A, B, and C on Figure 3-1 and Table 3-1. In Zone A, a relatively wide area (20 feet) of anomalous readings is present near the northwest corner of the trench. Although there is some effect from the wall, the cause of the anomaly is unknown. Zone B shows moderate magnitude anomalies (15 to 20 millivolts). Zone C near the northeast portion of the trench contains multiple anomalies. There is a high density of aluminum wall supports in this area and a portion of the anomalies is caused by the supports. Several isolated anomalies are also present within the area. The size and type of buried metal in these areas cannot be determined.

A total of nine anomalies labeled 5 through 13 were identified in the data from the north side of the trench that may be the result of isolated metal objects. Anomaly 10 is caused by a known five-gallon size drum at a depth of approximately 2.5 feet. The magnitude and areal extent of this anomaly is a good general indicator of what would be expected from a similar sized object. Anomalies 5 through 9 are smaller both in magnitude and areal extent, than Anomaly 10. These anomalies are likely caused by metal objects significantly smaller than a five-gallon drum and should be shallower than 2.5 feet. Depths to the center of buried metal could not be modeled for items on the north side of the trench due to interferences from metal in the temporary structure. Anomalies 11 and 12 are generally similar to Anomaly 10 in both magnitude and areal extent. Although it cannot be determined what the metal object causing the anomaly is, it may be of similar size to a five-gallon drum. It is also possible that several smaller closely spaced metal objects are responsible for the anomalies.

Anomaly 13 is similar in shape although smaller in size than Anomaly 1. It is located adjacent to a surveyed point and may be caused by a smaller survey nail.

3.3 Magnetic Data

The data from the magnetic survey are shown in a color-contoured form in Figure 3-2. The magnetic data is much more difficult to interpret than the EM61 data for several reasons. These include:

- More complex anomaly shapes.
- Poorer lateral resolution.
- Presence of ferromagnetic material adjacent to survey area.

The magnetic data generally shows the same features as the EM61 data although individual anomalies are not as readily apparent. For this reason, anomaly selection was mainly done utilizing the EM61 data.

4.0 SUMMARY

The EM61 data was the most effective at mapping buried metal objects at the Trench 1 site. The magnetic data showed similar features but was less effective at resolving the location of individual objects. A total of 13 suspected individual objects and three zones of multiple objects were identified in the data. The location of these zones and individual objects are shown on Figures 3-1 and 3-2 and are listed in Table 3-1. In addition, areas where anomalies are caused by metal objects located adjacent to the survey area are shown with X's on Figures 3-1 and 3-2.

Anomaly 10 is caused by a buried five-gallon drum at a depth of approximately 2.5 feet. Its size and shape are what would be expected for anomalies from similar sized objects. Anomalies 2, 3, 4, 5, 6, 7, 8, and 9 appear to be caused by buried metal significantly smaller than a five-gallon drum and likely are buried at shallow depths. Depth estimates were made for objects on the south side of the trench but cannot be done for those on the north side due to interferences. Anomalies 11 and 12 are within Zone C. They are similar size and shape to Anomaly 10 and may be caused by a similar sized buried metal object. It is possible that these anomalies are caused by several closely spaced smaller objects. They are located in a zone which appears to contain numerous buried metal items.

Anomaly 1 is located at a survey point set by RMRS within the Trench 1 building. Anomaly 13 is located adjacent to a survey point. They are similar in size and shape to what would be expected from a vertical metal rod. Anomaly 13 is larger and may be from rebar while Anomaly 2 could be caused by nail.

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5.0 CONCLUSIONS AND RECOMMENDATIONS

The geophysical surveys were effective at mapping buried metal objects at the Trench 1 site. The EM61 data was primarily used to identify buried metal objects. The presence of metal within the housing structure affected data collected on the north side of the trench resulting in more complex anomalies in this area.

A total of 13 individual buried metal items were interpreted. Two of the anomalies are generally similar in size and shape to a known five-gallon drum buried at the site. Eight of the items are much smaller than the drum anomaly and are likely small metal items buried at shallow depths. Two other anomalies are likely caused by buried metal survey stakes.

Three zones of multiple buried metal objects were identified. Zone A is near the northwest edge of the trench and based on depth to the caliche zone only a couple feet of fill may be present. Zone B has lower magnitude EM61 anomalies and likely caused by small metal objects. Zone C is the most complex area and contains two identified individual anomalies similar in size to the known drum anomaly. Due to the complex anomalies in this area, other buried objects of similar size to the drum may be present but not separately observed in the data. This area of the survey site has the highest potential for additional buried drums and should be investigated accordingly.

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Geophysical Surveys for Buried Waste Site Assessments

Introduction

Surface geophysical surveys, when properly planned, executed, and interpreted can significantly reduce intrusive testing and costly analytical work. It can set the framework for selecting drill hole and sampling locations, and can be used to extrapolate results to areas beyond the immediate drill hole or trench. This technical note is a brief overview of available technology at a point in time when, particularly in data display and processing, great strides are being made.

Geophysical methods commonly employed in surveys for buried waste are listed in Table 1 on pages 2 and 3 of this Technical Note. Although these various geophysical methods differ in many respects, all effective geophysical programs need to address the following factors:

The generation of sound geological and site history models based on available information.
Such models are used to guide the selection of geophysical techniques and survey parameters. The successful application of particular methods can be highly site specific. The attainable data quality can often be anticipated from a knowledge of site conditions and models based on preliminary data from the area.

The use of multiple geophysical techniques.
The use of multiple techniques allows different objectives to be addressed and different depth ranges to be explored. Moreover, confidence in inferring geological features or the locations of contaminant sources from geophysical data is enhanced when the interpretation is supported by more than one technique.

Infield (real time) data interpretation.
Infield data interpretation allows adjusting survey parameters and changing geophysical methods to achieve objectives. Real -time interpretations require data acquisition in solid state memory loggers for transfer to personal computers, versatile software for data analysis, and personnel experienced with the full range of geophysical methodologies.

Effective display of data.
Presence of buried waste is inferred from anomalous values of geophysical measurements differing from those of background. Background values can also change due to a number of natural causes, such as variation in soil types, depth of overburden, and elevation differences. The recognition of background trends and the ability to differentiate between background and anomalous features due to buried waste is facilitated by optimum display formats.

An integrated approach to interpretation.
Geophysical interpretations clearly must be consistent with all available geologic and drilling data. Proof of specific features must exist both in geophysical interpretations and in geologic mapping, sampling or drilling. If the inferences drawn from geophysical data can be verified by intrusive testing at selected locations, then this verification can subsequently be extrapolated over larger areas.

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MAGNETIC SURVEYS
Principles of Operation

The signals measured in a magnetic survey are partially the result of and strongly influenced by the ambient magnetic field of the Earth. The Earth's magnetic field resembles that of a single axis dipole with a south magnetic pole directed towards the geographic north pole. The strength of the Earth's magnetic field is about 60,000 gammas near the poles where it is directed vertically into the Earth, and about 25,000 gammas near the equator where it is parallel to the Earth.

Buried ferromagnetic objects cause local perturbations in the Earth's magnetic field (Fig. 1). The Earth's magnetic field induces a magnetic moment per unit volume in ferromagnetic material, and this induced magnetization is parallel with and proportional to the local Earth's magnetic field. Therefore, the intensity and shape of perturbations caused by a buried drum varies with the latitude across the Earth (Fig. 2). The total magnetic field measured is the vector sum of the ambient Earth's magnetic field, plus local perturbations caused by buried objects.

Magnetic field measurements are typically made with proton precession magnetometers (Fig. 3), and both total magnetic field and the vertical gradient of the magnetic field can be measured simultaneously.

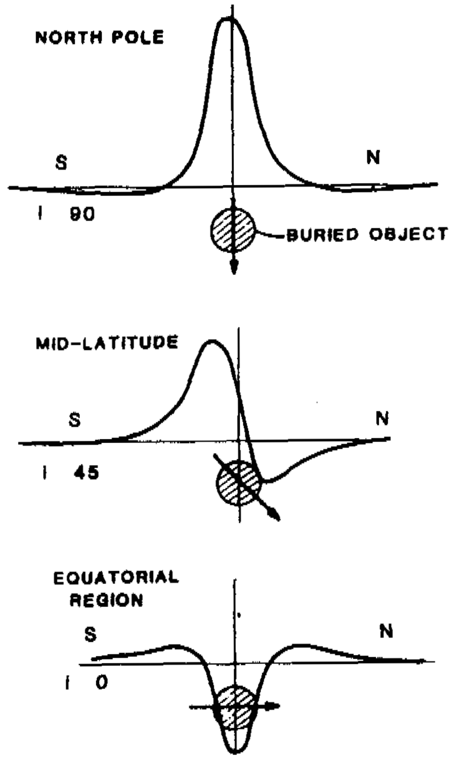

Figure 2 Shape of local perturbations (anomalies) in total magnetic field change with latitude.

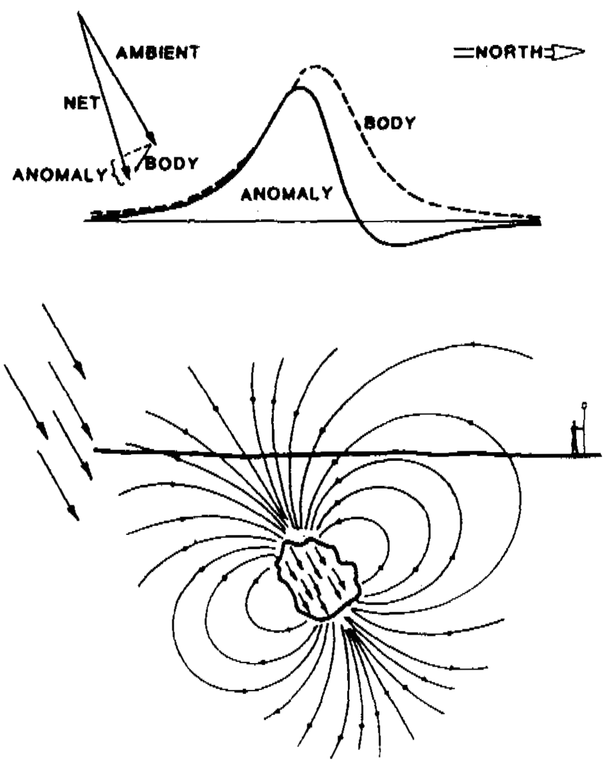

Figure 1 The earth's magnetic field induces a magnetic moment per unit volume in buried ferromagnetic debris (bottom). This causes a local perturbation (anomaly) in total magnetic field (top).

Figure 3 Proton Precession Magnetometer

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Table 1. Summary of Common Geophysical Methodologies in Site Assessment

Geophysical Methodology	Physical Property Measured	Applications and Limitations
Magnetic Surveys	• Total Magnetic Field • Vertical gradient of magnetic field	• Detection of ferromagnetic debris, drums, UST's, landfill boundaries, uncontrolled waste pits and trenches • Limited applications within areas with extensive infrastructures and surface debris
Frequency Domain EM Profiling	• Ground conductivity • Anomalies in EM field caused by metallic objects	• Detection and delineation of waste pits, trenches, and landfill boundaries • Contaminant plumes dissolved in ground water • Limited applications within areas with extensive infrastructures and surface debris
Time Domain EM Object Detector	• Anomalies in transient EM fields	• Detection of electrical conductive buried objects, pipes, waste pits and trenches, landfill boundaries, cells within landfills • Interferences by infrastructure substantially mitigated
Ground Penetrating Radar (GPR)	• Two-way travel time to reflections caused by changes in dielectric constants	• Detection of buried waste, waste trenches and pits, and voids • Can often be employed in areas with extensive infrastructures • Search depth highly site specific
Metal Detectors/ Pipe Detectors	• Distortions in EM fields	• Detection of metallic objects and pipes • Limited search depth

Practical Aspects of Operation

(1) Correction for Drift

The Earth's magnetic field generally drifts slowly over time (typically a few gammas per hour), but it can also have large diurnal variations (Fig. 4). In fact, during geomagnetic storms these variations can be so large as to preclude meaningful magnetic field measurements. Usually, diurnal variations can be dealt with in environmental surveys in a number of ways, such as

- Magnetic field perturbations caused by isolated drums or underground storage tanks (UST'S) have small spatial wavelength (1 0 ft. to 20 ft.), and measurements over such distances take minutes. Thus, spatially "tight" perturbations caused by drums can be readily recognized in the presence of normal drift.

- For larger areas (e.g., landfills) a base station is reoccupied with a roving magnetometer at regular intervals, and data are corrected for the drift observed over time at the base location, or

- A base station magnetometer is set out , that continuously records the Earth's magnetic field.

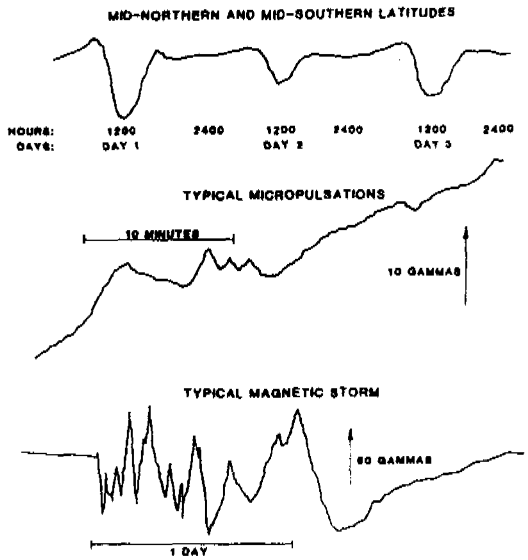


Figure 4 Variations in Earth's magnetic field over time

(2) Selection of Survey Parameters

The selection of survey parameters must be adapted to the mapping objective, and the spatial dimensions of the anomaly anticipated. These dimensions depend on depth of burial and sizes of buried objects searched for. For a single drum buried 3 ft. below the surface, the spatial dimension of the anomaly typically is less than 20 ft. Therefore, a survey directed to detect a single drum should use a grid spacing of not more than 1 0 ft., and preferably 5 ft. It can perhaps be larger in searching for UST's or multiple drums buried together.

Applications and Limitations

Magnetic surveys have their main application in site assessment for:

- Locating buried drums, UST's and pipes,
- Delineating pits and trenches with ferromagnetic metals,
- Delineating boundaries of landfills with ferromagnetic debris.

Some limitations of magnetic surveys are:

- Power lines interfere with measurements,
- In areas with extensive metallic debris scattered over the surface no distinction can be made between surface debris and buried debris,
- Metallic structures, such as buildings, fences, and reinforcement rods in concrete interfere with measurements.

ELECTROMAGNETIC INDUCTION PROFILING
Principles of Operation

In electromagnetic (EM) induction profiling the conductivity of the subsurface is measured. When debris is buried, conductivity generally changes for two reasons:

(1) Buried debris has different conductivities than native soils. Conductivities can be either lower e.g., construction debris) or higher (e.g., sludges, metallics).

(2) The disturbance of native soils caused by excavation changes conductivity.

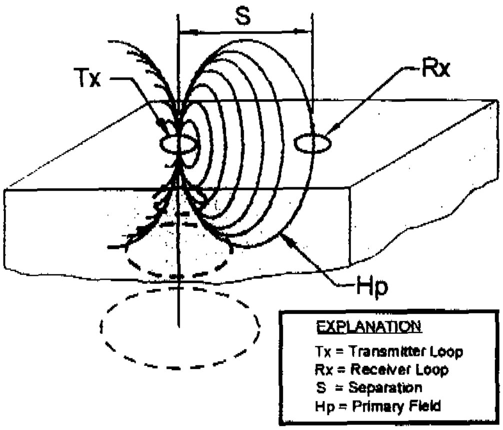
An EM system consists of a transmitter (Tx) and a receiver (Rx). Through the transmitter a sinusoidal current waveform is driven, and the primary EM field of the transmitter causes eddy current flow in the subsurface (Fig. 5). The intensity of these eddy currents is a function of ground conductivity. The eddy currents in turn cause a time-varying secondary EM field that is measured as a voltage in the receiver

In the two most common instruments employed in site assessment (Geonics EM-31 and EM-34), frequency of operation and spacing have been selected so as to make search depth relatively independent of ground conductivity, and the instrument meter provides a direct readout in apparent conductivity.

The secondary magnetic field caused by eddy current flow in the ground has an in-phase and quadrature phase (90' out-of-phase) component with the current waveform driven through the transmitter, and both components are small over ground with conductivities less than 1 00 millimhos/m (typically less than 1 part in 104 parts), and only the quadrature phase component can be measured to such accuracies

Over metallic objects, which have extremely high conductivities, both quadrature and in-phase components can reach tens of percent of the primary field.

PRIMARY MAGNETIC FIELD



SECONDARY MAGNETIC FIELD

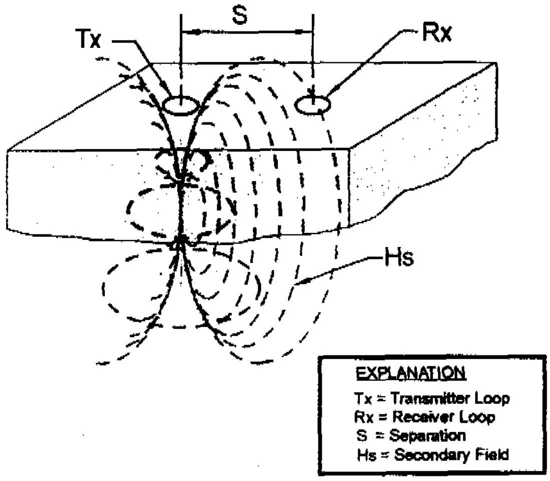


Figure 5 Schematic illustration of eddy currents in subsurface caused by primary magnetic field of Tx.

Figure 6 Geonics EM-31. Effective search depth between 10 ft. And 15 ft.

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Figure 7 Geonics EM-34. Effective search depth depends on Tx-Rx separations and Coil orientation

Measuring both quadrature phase and in-phase component with the EM-31 (Fig. 6) allows differentiation between waste with (e.g., municipal fill) and without (e.g., sludges) metallic debris.

With the EM-34 (Fig. 7) only the quadrature phase component (ground conductivity) can be recorded, because the in-phase component is used for electronically measuring coil separation.

Applications and Limitations

EM surveys have their main application in site assessment for:

- Searching areas for uncontrolled waste pits and trenches of unknown location,
- Determining boundaries of landfills, sludge lagoons, and other burial sites,
- Determining leachate plumes emanating from buried contaminants,
- Locating buried drums, UST's and other metallic buried objects.

Some of the limitations of EM surveys are:

- Metallic structures, such as buildings, buried utilities, metal fences and reinforcements in concrete interfere with measurements;
- In areas with extensive metallic debris scattered over the surface, no distinction can be made between surface debris and buried debris.

TIME DOMAIN EM BURIED OBJECT DETECTOR
(Geonics EM-61)
Principles of Operation

The principles of operation of a time domain EM (TDEM) buried object detector are similar to that of frequency domain systems (Geonics EM-31 and EM-34). A major difference is in the system waveforms used (Fig. 8). In the EM-61 TDEM system, a half-duty cycle waveform is used, and measurements are made during the time the trans mitter is off. This difference has a major impact on reducing noise and improving signal due to buried objects.

A photograph of the EM-61 is shown in Figure 9. The system consists of one transmitter and two receiver coils. The bottom coil is a transmitter during current on-time, and a receiver during off-time. The top coil, mounted 40 cm above the bottom coil, is a receiver only. The transmitter and receiver electronics controls are mounted in a backpack. The data logger, connected to the electronics, is hand-held.

Briefly, the rationale for employing time domain systems are:

(1) In a frequency domain system (Fig. 6 & 7) the voltage measured at the receiver is the sum of voltages due to the electromagnetic field of eddy currents flowing in the subsurface (useful signal), and the primary magnetic field due to currents driven through the transmitter and coupled to the receiver through the air. This latter component contains no useful information about the subsurface. Yet, this voltage is often several orders of magnitude larger than the secondary magnetic field due to currents induced in the subsurface. All frequency domain systems, therefore, have the disadvantage of measuring a small useful signal (due to ground eddy currents) in the presence of a large signal (primary field) containing no information about the subsurface.

(2) The voltage measured in the receiver due to eddy currents induced in the subsurface will have two contributions: (i) due to currents induced in surrounding soils (V.), and (ii) due to currents in buried objects (V.). For buried waste detection, the goal is to maximize the ratio V./V.. It has been shown that currents in surrounding soils decay faster than currents in conductive (e.g., metal) objects, so that there will be a time range over which Vps is maximum. Use is made of this fact in the design of the EM-61 by recording the voltage in a time gate where VJV, is expected to be maximum, and currents in surrounding soils have largely dissipated.

Field experiences have shown that the theoretical advantages of TDEM systems are realized in the EM-61 in practice. Some of these advantages are:

(1) The signal due to buried targets is enhanced and background signal due to surrounding soils is low. Performance is near independent of soil type.

(2) Lateral resolution of measurements is better than for frequency domain systems, and the radius of interference by above ground metallic objects (fences, buildings, power lines, etc.) is reduced.

(3) The anomalies of buried objects is of simple shape, facilitating identifying and positioning buried objects

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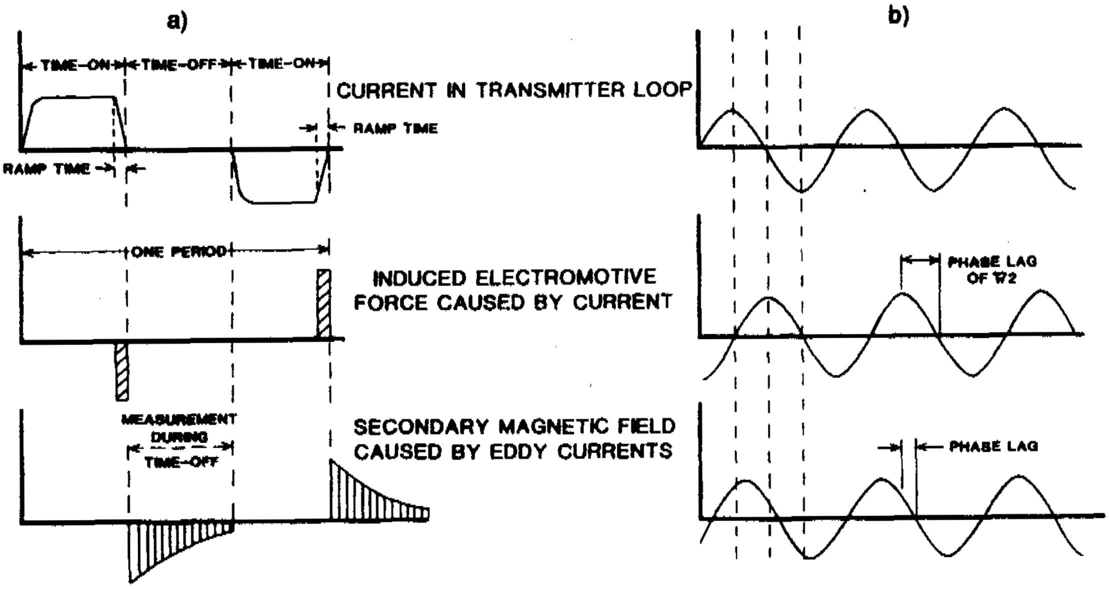

Figure 8 System waveforms used in time domain a) and frequency domain b) systems

Applications

The Geonics TDEM EM-61 buried object detector will have its main application for:

- Locating buried drums, UST'S, and other metallic buried objects,
- Searching areas for uncontrolled waste pits and trenches

GROUND PENETRATING RADAR
Principles of Operation

Ground penetrating Radar (GPR) is based on the same principles as aircraft and shipboard radar. Short duration EM pulses of high frequency (80 megahertz to 1,000 megahertz) generated by a transmitting antenna propagate into the ground and are reflected from discontinuities in the subsurface back to a receiving antenna (Fig. 10). The same antenna can be used for transmitting and receiving (monostatic) or separate antennae can be employed (bistatic).

There are two major differences between aircraft and shipboard radar and GPR:

(1) In aircraft and shipboard radar the main objects reflecting radar signals are large metallic objects (other ships and aircraft) or land masses. In GPR reflections can be caused by boulders, changes in water content, changes in density, voids, buried objects, and etc.

(2) Aircraft and shipboard radar signals propagate through media with relative low attenuation (air); in GPR, attenuation in the subsurface can be very large because the ground has a finite electrical conductivity.

In GPR the velocity of propagation in the ground is determined by the dielectric constant, and the attenuation mainly by ground conductivity and scattering. The dielectric constant of ground is largely determined by water content, because the relative dielectric constant of water is 80, and that of rock and soil minerals typically is between 3 and 6. Velocity of propagation may change by about a factor 3, depending on water content. Attenuation is related to ground conductivity and is mainly a function of clay content and dissolved solids in ground water. Small percentages of clay can rapidly increase attenuation of GPR signals, and limit its effective search depth.

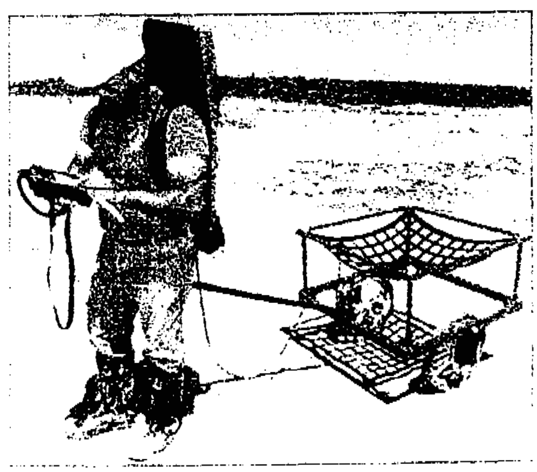

Figure 9 Photograph of EM-61 and operator

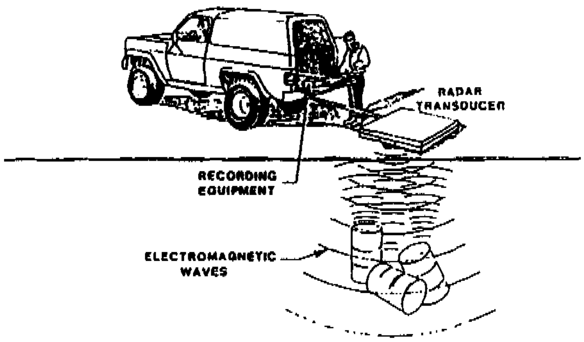

Figure 10 Schematic survey layout for GPR system

Practical Aspects of Operations

GPR surveys are performed by pulling the antenna over the ground surface to generate a GPR profile. A typical profile is shown in Figure 1 1 where the horizontal axis is distance along the profile, and the vertical axis is two-way travel time from the antenna to a reflector in the subsurface.

The survey productivity is highly dependent on access. It is high with vehicle access and lower for foot access. In brush, GPR surveys require a wider and smoother path and more thorough clearing than EM or Mag surveys.

Applications and Limitations

Thus, GPR signals are reflected from discontinuities in dielectric constant in the subsurface. Typical reflecting boundaries can be:

- Buried waste, drums, UST'S, and pipes,
- Trenches and pits cause local disturbances in soil, layering, and even if buried objects in such trenches are not seen, the trench and pit walls can often be recognized on radar records by disruption of native soil layers,
- Voids and old mine workings.

The advantages of GPR is its high resolution but limitations include:

- Effective search depth is highly site specific and difficult to predict. For example a clay cap 2 ft. to 3 ft. thick over a landfill may screen GPR from penetrating below the fill. In clay or saline soils, drums or UST's buried 2 ft. to 3 ft. down may not be detectable.

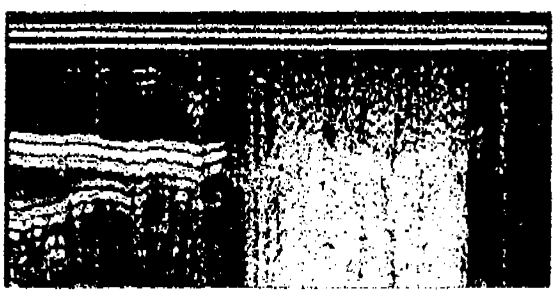

Figure 11 Typical GPR record over trench

METAL DETECTORS AND UTILITY LOCATORS
Principles of Operation

There are many different types of metal and utility locators, but all are designed to detect metallic objects. The operation of these instruments is based on one of the two principles given below:

- Sensing changes in the gradient of the magnetic field caused by local perturbations due to ferromagnetic objects (Fig. 12),
- Sensing the secondary EM fields due to a cable or metallic pipes (Fig. 13).

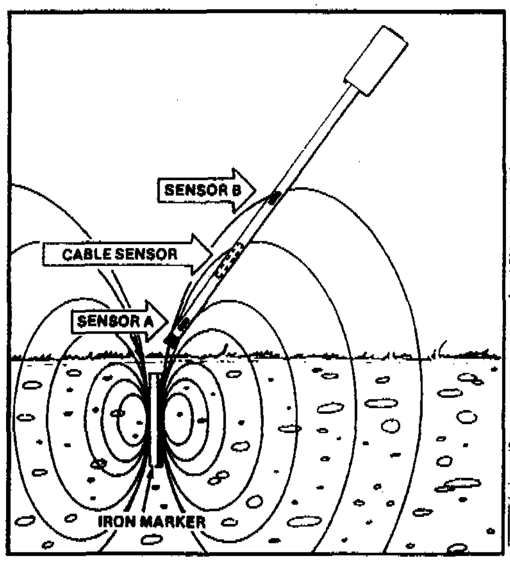

Figure 12 Schematic of principle of operation of metal detector using gradient in magnetic field.

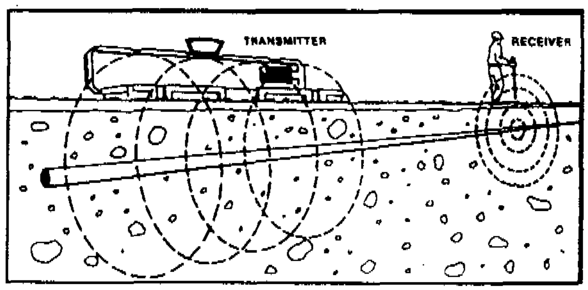

Figure 13 Schematic of principles of operation of pipe locator using anomalies in EM field caused by current flow induced in pipe.

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Practical Aspects of Operation

The output from these detectors typically is an audio signal varying in frequency or volume across a target. Therefore, contour maps of profiles for further processing and display are not produced. Survey procedures generally consist of defining the boundaries of the area to be surveyed, and then "sweeping" it with a detector. Because the response of the targets is not recorded, these targets are marked or staked during the survey.

Applications and Limitations

Metal detectors and utility locators have their main application in site assessment for:

Sweeping small areas for buried metallic objects, such as

- Screening selected drilling or other intrusive sampling locations,
- Detecting UST's and underground utilities at gas stations,
- Locating utility lines,
- Locating critical metallic objects of limited dimensions buried within one foot from the surface (e.g., ordnance).

Limitations are:

- They are strictly anomaly detectors and are not suited for providing quantitative information,
- They have limited exploration depth.

CASE HISTORIES

White Sands Missile Range, New Mexico

The requirements for site assessment on the White Sands Missile Range are typical of those encountered on other military and DOE facilities throughout the U.S. Common characteristics of site assessment at such facilities are:
(1) They have generally been in operation since the 1940's and burial of various types of material occurred in many uncontrolled pits and trenches. Their location is at best only approximately known, generally covered by fill and overgrown.
(2) Disposal in landfills was not monitored, so that "hot spots" occur where sludges and other liquid wastes may have been disposed.
(3) Sources of contamination may exist in areas used for fire training, burn pits and maintenance.

An effective surface geophysical approach as part of an overall site investigation may consist of:

- Surveys with a magnetometer along a surveyed grid. The line and station spacing generally depends on objective and details of prior information;
- Surveys with EM equipment along the same grid;
- Confirmation surveys with GPR if sufficient penetration depth is anticipated.

The case history below illustrates a typical survey. The objective of this survey was to map the lateral boundaries of a landfill abandoned in the 1960's.

Figure 14 shows the results of stacked profile plots of EM surveys with the Geonics EM-31. Measurements were made along lines spaced at intervals of 50 ft. and with 10 ft. station intervals along the lines. These survey parameters were selected because the approximate landfill boundaries were known, and the main objective was to determine the edges of the landfill. A line spacing of 50 ft. was sufficient to interpolate boundaries between lines. However, to map edges effectively, a 1 0 ft. station interval was selected along the lines.

An increase in apparent conductivity occurs along each profile from background onto the landfill, and the edges of the landfill are readily determined. Isolated anomalies are also observed outside the landfill boundary.

The survey outlined on Figure 14 was completed in 1 1/2 days of field work, and a framework for further investigation was established quickly. Stacked profile plots appear to be an optimum mode for data display here.

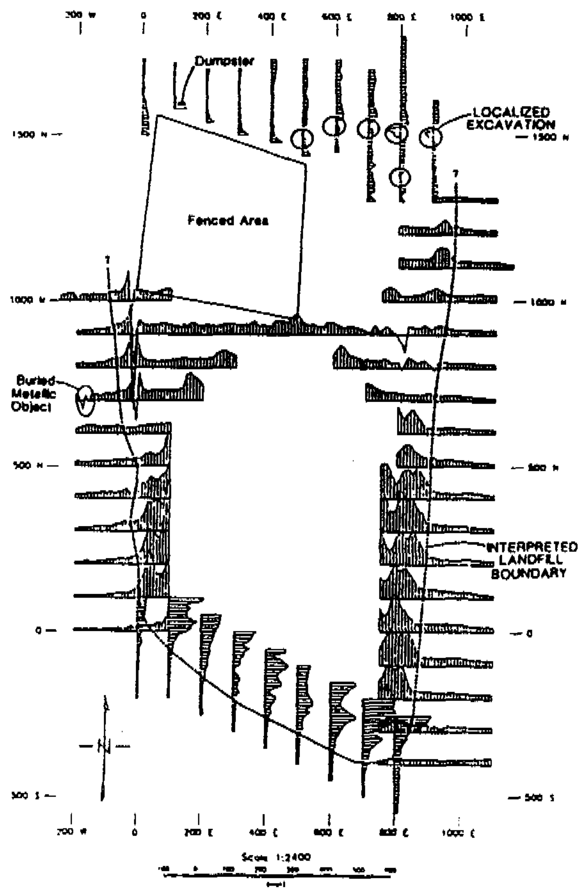

Figure 14 Stacked EM-31 apparent conductivity plots to locate landfill boundaries

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Idaho National Engineering Laboratory (INEL)

At INEL a trench has been constructed for the purpose of testing, detection and characterization of buried wastes by geophysical methods, and various retrieval technologies. Different objects, such as drums, wooden crates, and plastic vessels have been placed in the trench. Over this trench, data were acquired with a number of sensors, such as a EM-31, a proton precision magnetometor, EM-61 (time domain metal detector) and GPR. Measurements were made on a 2.5 ft. Grid. Results obtained with the EM-61 are given in Figure 15 in contour form and in Figure 16 as a 3-D perspective plot.

In evaluating the results of different sensors, the EM-61 proved most successful because of its low background noise, allowing good delineation of trench boundaries and berms between burial cells. Also, it had a high resolution for delineating individual objects within the trench.

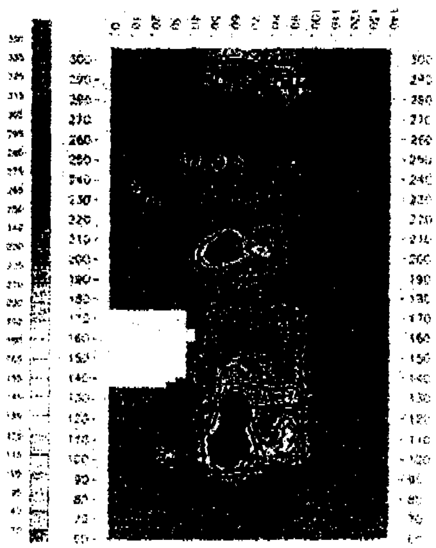

Figure 15 Color EM-61 Contour Map

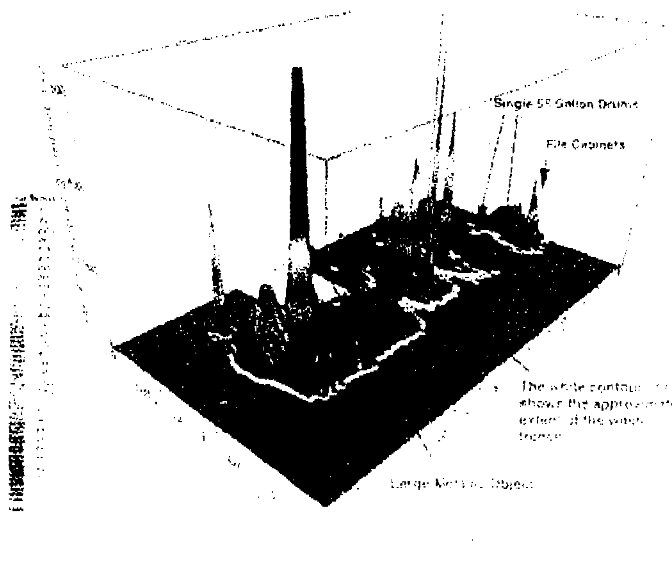

Figure 16 EM-61 3-D Perspective Plot

Case History of Ground Penetrating Radar (GPR)

The case histories of the White Sands Missile Range and INEL have in common that a relatively large area (several acres to 100 acres) must be covered over terrain that may contain arroyos, rocks and boulders, and vegetation of various types. The portability of EM and Mag equipment make various types of surveys well suited over such terrain. GPR equipment is less suited for surveys over all types of terrain, and in these situations GPR surveys are best used as confirmation surveys over selected line segments. There are, however, a large number of applications in site assessment ideally suited for GPR as a primary tool, such as:

(1) Surveys in highly built-up areas, e.g., Within Naval Shipyards, refinneries, and chemical plants, where interferences by the infrastructure prohibits effective use of EM and Mag.
(2) Surveys over small areas with good surface access (e.g., gas stations, roads, paved areas).
(3) Surveys for objectives with imited or no EM or Mag signatures, e.g., Underground voids, abandoned mine workings.

Example

Voids in the ground can be difficult to detect by EM, resistivity, seismic, gravity or magnetic surveys. Detection with these methods is strongly dependent on their depth of occurrence and size of the cavity. If the depth to the top of the cavity is shallow, and the ground is relatively resistive, GPR surveys can detect cavities. An example of a GPR survey for detecting abandoned mine workings is shown in Figure 17. In this area soil cover over limestone bedrock was relatively thin.

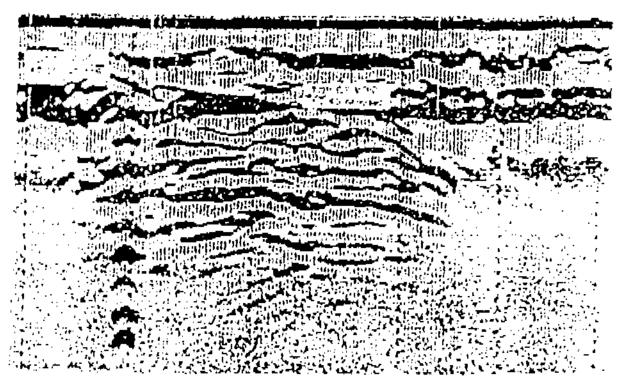

Figure 17 GPR record over an old mine working

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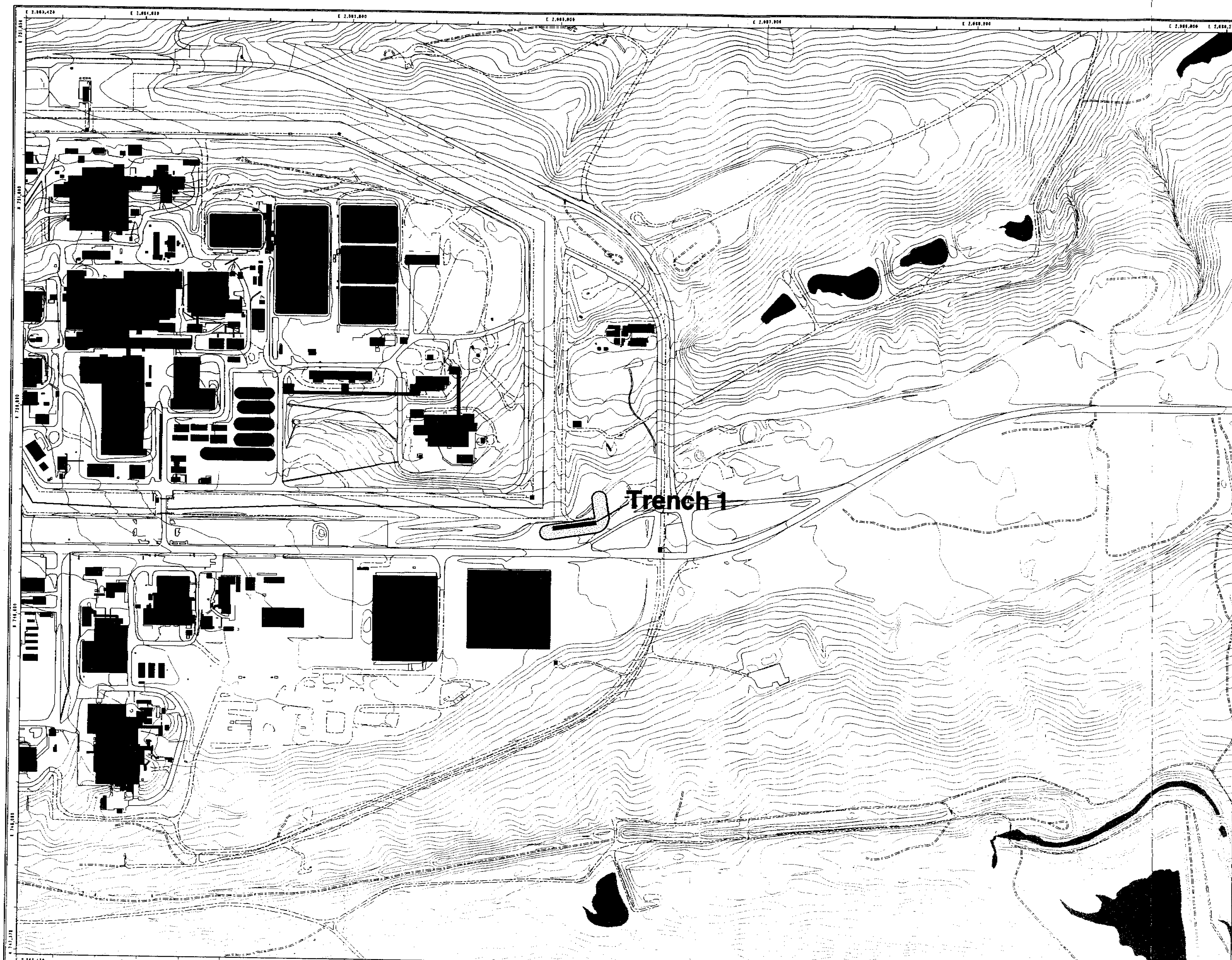

Figure 1-1

Trench 1
Site Location

EXPLANATION

Contours (5' intervals)

Trench 1 Tent

Trench 1

Standard Map Features

Buildings and other structures

Lakes and ponds

Streams, ditches, or other drainage features

Fences

Paved roads

Dirt roads

DATA SOURCE:
Buildings, fences, hydrography, roads and other structures from 1994 aerial fly-over data captured by EG&G RSL, Las Vegas.
Digitized from the orthophotographs. 1/95

Scale = 1 : 5430
1 inch represents approximately 453 feet

100 0 200 400 ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:

RMRS Rocky Mountain Remediation Services, L.L.C.
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P.O. Box 464
Golden, CO 80402-0464

MAP ID: 97-0066

January 15, 1999

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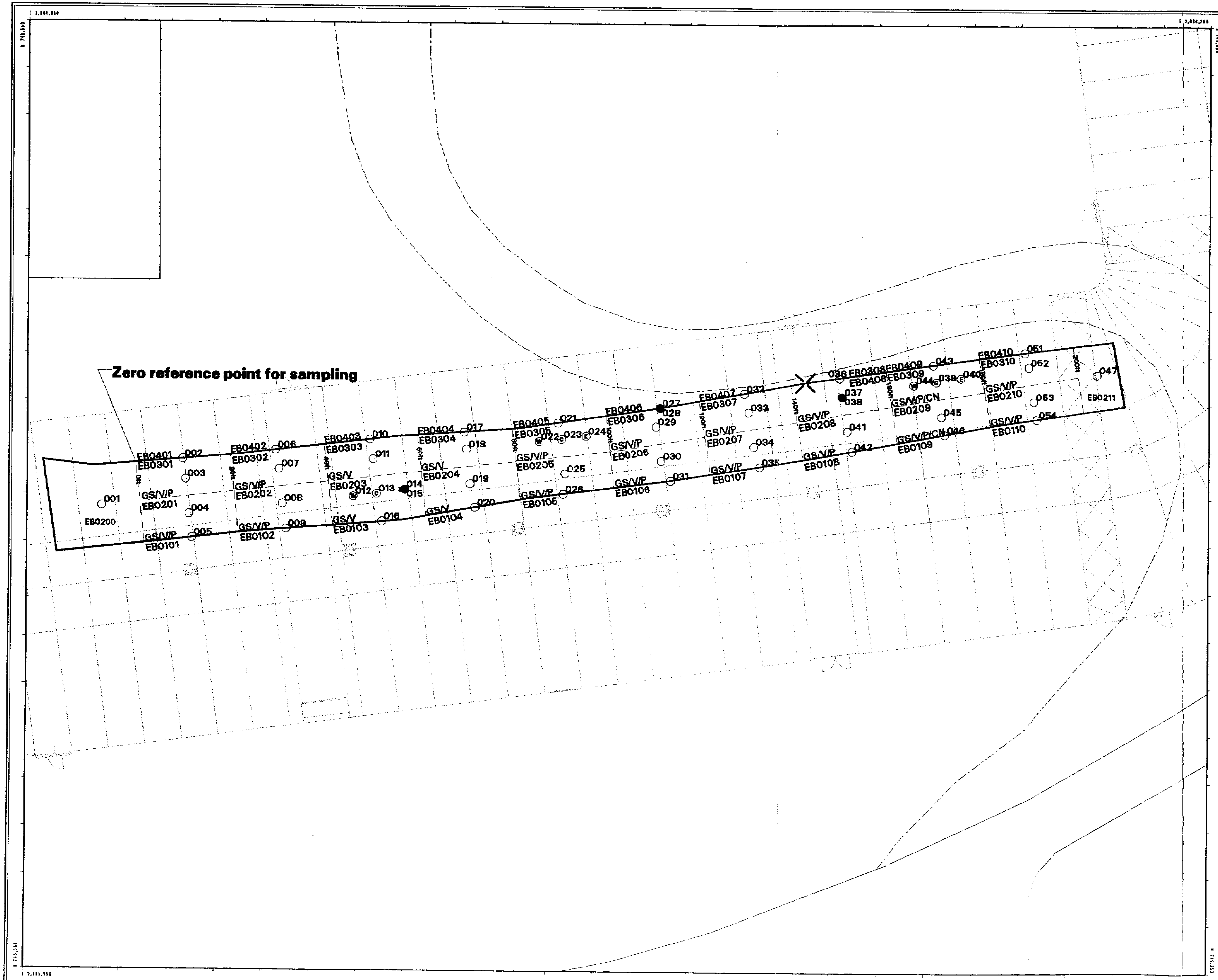

Figure 4-1
Trench 1
Excavation Verification Sample Locations

EXPLANATION

- Location of 5-gal Container
- Excavation Boundary
- Approx. Trench Grid Location
- Tent Location
- Sample Location
- Sample + Duplicate

EB0201 = Sample Location
052 = Abreviated Sample Number Representing 98A211-052
GS = Gamma Spectroscopy Analysis
V = Volatile Organic Compound Analysis
CN = Cyanide Analysis
P = PCBs
W = Western Third of 20' Sample Cell
C = Center Third of 20' Sample Cell
E = Eastern Third of 20' Sample Cell

Standard Map Features

- Fences and other barriers
- Paved roads
- Dirt roads

DATA SOURCE: Buildings, fences, hydrography, roads and other structures from 1994 aerial fly-over data captured by EG&G RSL, Las Vegas. Digitized from the orthophotographs. 1/95

Scale = 1 : 240
1 inch represents 20 feet

5 0 10 20ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

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MAP ID: 99-0130

May 06, 1999

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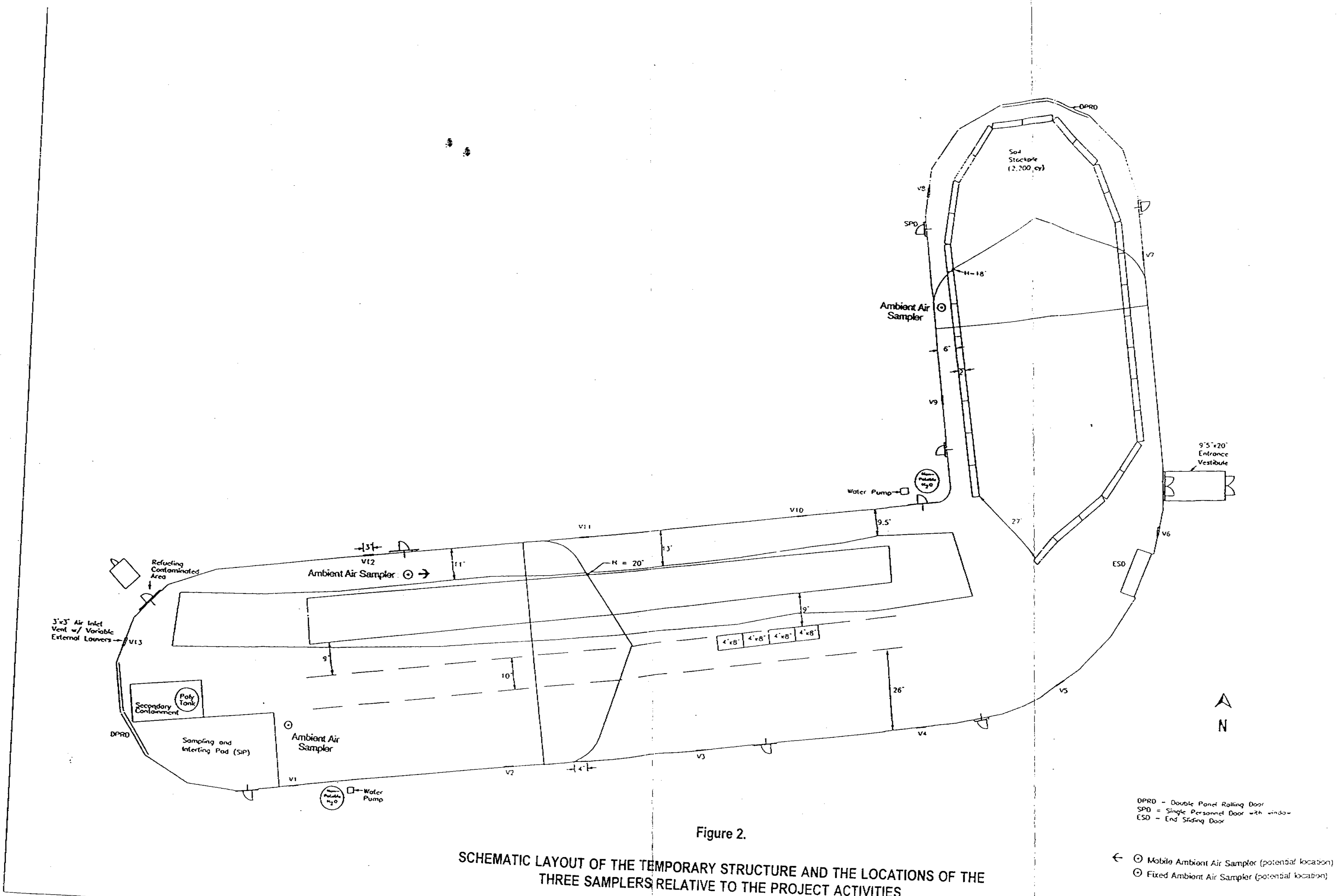

Figure 2.

SCHEMATIC LAYOUT OF THE TEMPORARY STRUCTURE AND THE LOCATIONS OF THE THREE SAMPLERS RELATIVE TO THE PROJECT ACTIVITIES

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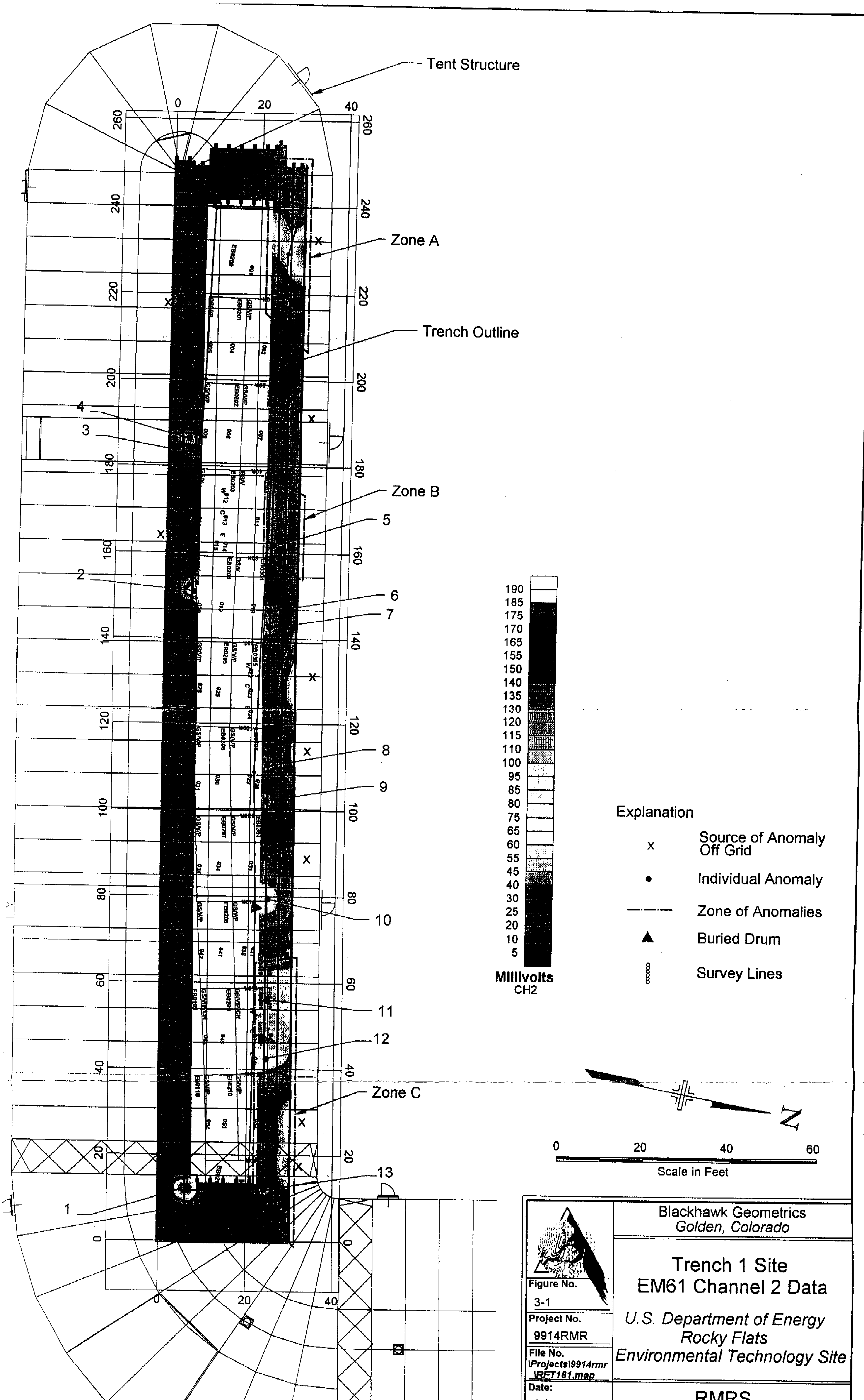

	Blackhawk Geometrics *Golden, Colorado*
Figure No. 3-1	Trench 1 Site EM61 Channel 2 Data
Project No. 9914RMR	*U.S. Department of Energy* *Rocky Flats* *Environmental Technology Site*
File No. *\Projects\9914rmr \RFT161.map*	
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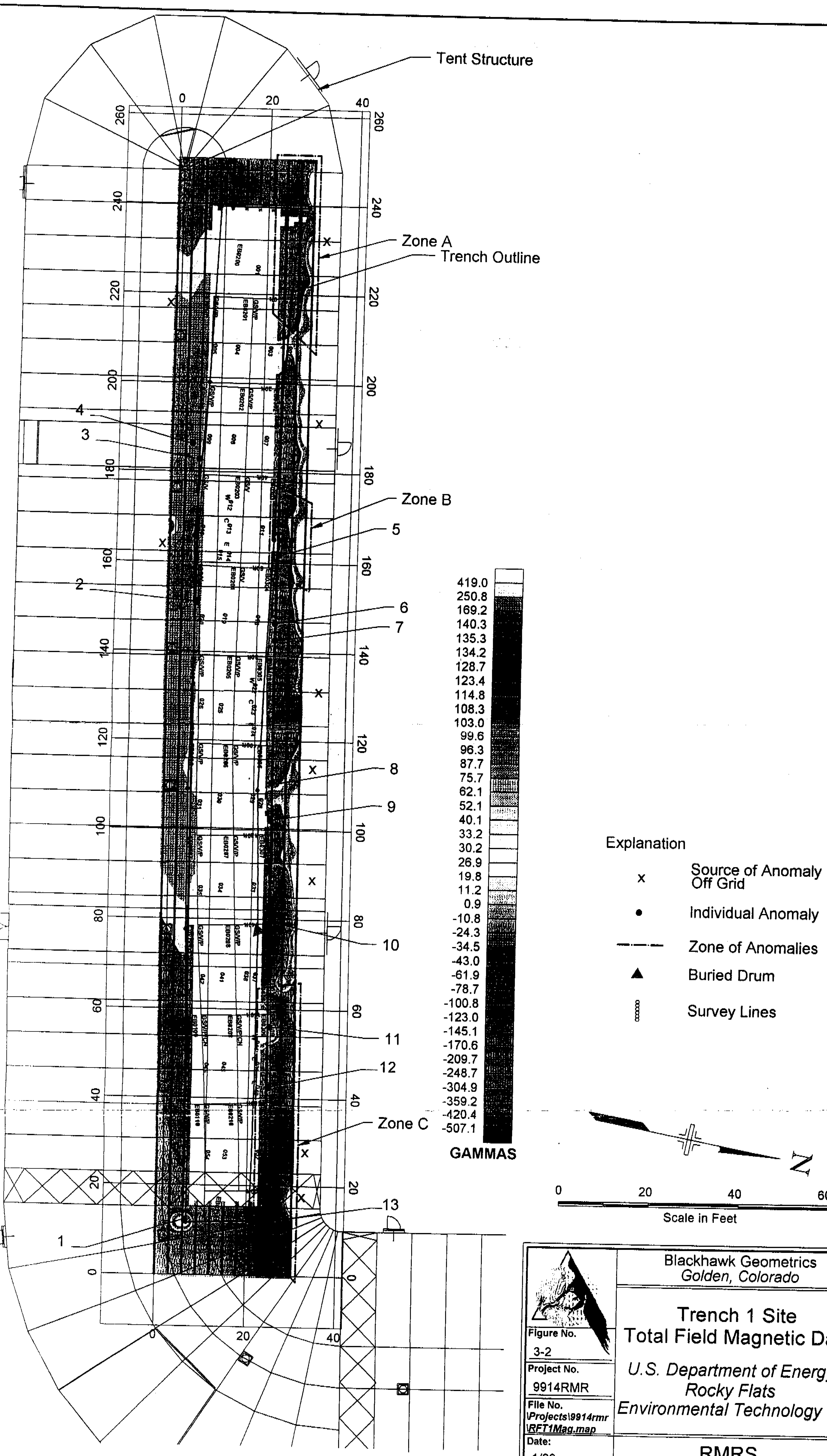

Blackhawk Geometrics
Golden, Colorado

Trench 1 Site
Total Field Magnetic Data

U.S. Department of Energy
Rocky Flats
Environmental Technology Site

Figure No. 3-2

Project No. 9914RMR

File No. \Projects\9914rmr\RFT1Mag.map

Date: 1/99

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